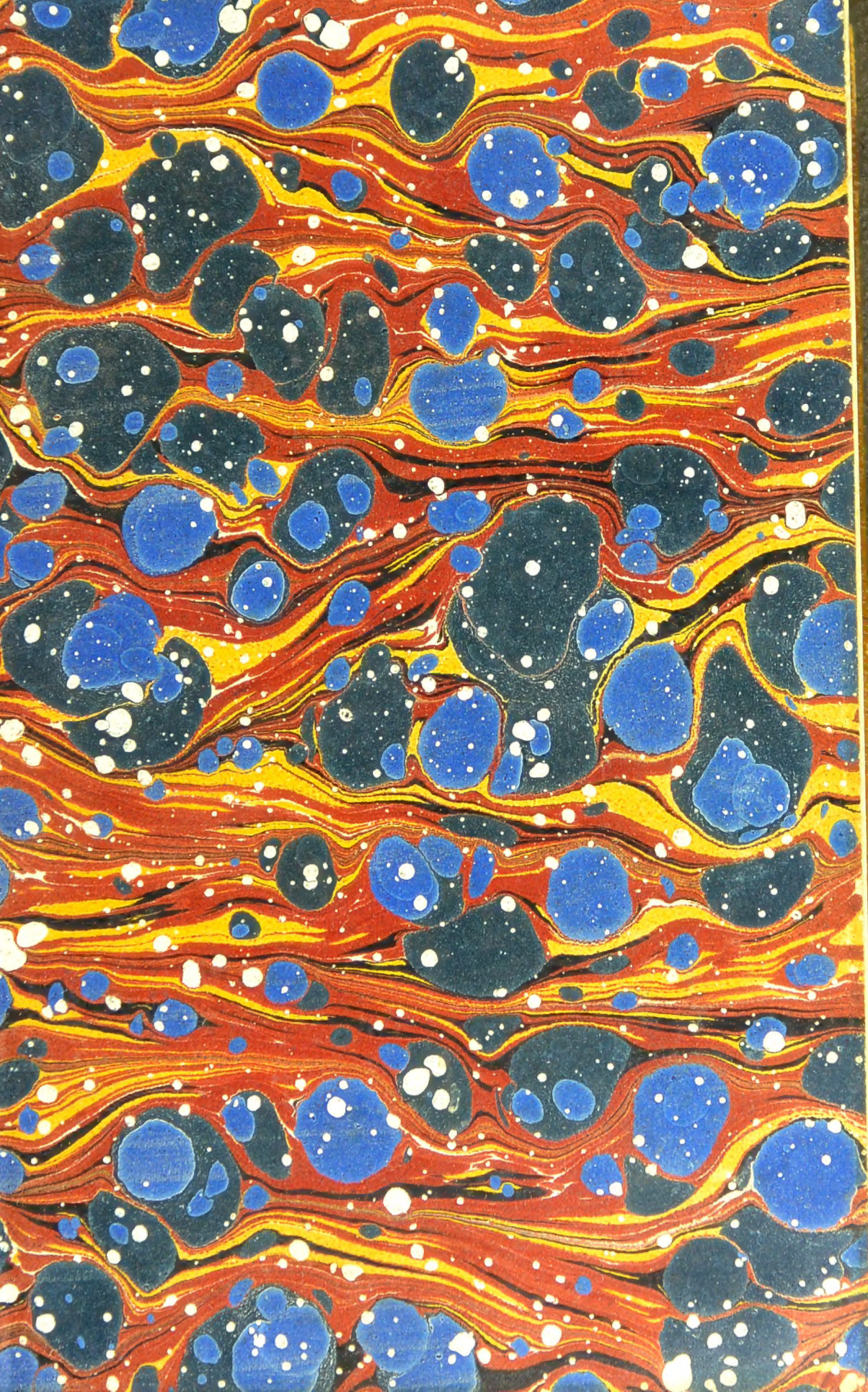






22101336595









A
SYSTEM OF SURGERY.

VOL. IV.

DISEASES OF THE ORGANS OF DIGESTION,
OF THE GENITO-URINARY SYSTEM, OF THE BREAST,
THYROID GLAND, AND SKIN;
APPENDIX OF MISCELLANEOUS SUBJECTS:

WITH A
GENERAL ALPHABETICAL INDEX AND LIST OF AUTHORS.

LONDON:
ROBSON AND SON, GREAT NORTHERN PRINTING WORKS,
PANCRAS ROAD, N.W.

A
SYSTEM OF SURGERY,
THEORETICAL AND PRACTICAL,
IN
TREATISES BY VARIOUS AUTHORS.

EDITED BY

T. HOLMES, M.A. CANTAB.

ASSISTANT SURGEON TO ST. GEORGE'S HOSPITAL AND TO THE HOSPITAL FOR SICK CHILDREN.

IN FOUR VOLUMES.

VOLUME THE FOURTH.

*DISEASES OF THE ORGANS OF DIGESTION,
OF THE GENITO-URINARY SYSTEM, OF THE BREAST,
THYROID GLAND, AND SKIN;
APPENDIX OF MISCELLANEOUS SUBJECTS:*

WITH A
GENERAL ALPHABETICAL INDEX AND LIST OF AUTHORS.

LONDON:
LONGMAN, GREEN, LONGMAN, ROBERTS, AND GREEN.

1864.

The Right of Translation is reserved.

M19221

WELLCOME INSTITUTE LIBRARY	
Coll.	W0100
Call	
No.	1860-
	H75s

PREFACE TO VOL. IV.

IN submitting to the judgment of the Profession the concluding volume of this "System of Surgery," no long Preface will be necessary. The past volumes have been received so very favourably, that the Editor has nothing better to wish for the whole book than that it may obtain the same good report as its parts. The Work has been completed strictly in accordance with the plan announced in the first volume. That this plan makes no pretension to scientific precision, is plain upon the face of it; but it appeared to the Editor to be the most suitable for the convenience of a large number of independent authors; whilst the advantages of a strictly scientific arrangement of the heterogeneous topics which must be included in a general work on Surgery are, to say the least, doubtful. In order to obviate ambiguity or difficulty in discovering any topic, a copious Table of Contents and Index have been drawn up; and in constructing the latter, the Editor has endeavoured to curtail its bulk as much as should be consistent with fulness. The order in which each subject is treated is amply set forth in the Contents; so that if a reader wishes to study any portion of a subject, he would first find the place of that subject in the Work by means of the Index, and then consult the Table of Contents of the

volume referred to. The Editor is so impressed with the importance of a good and full index to a long work like this, that he will be greatly obliged by information of the errors and omissions which cannot fail (in spite of all due pains on his part) to exist in this Index. By consulting the chief authors quoted and referred to in each essay, the student will obtain a tolerably complete list of the best monographs on surgical subjects in the English language.

Nothing now remains to him except the pleasing duty of offering his best and most cordial thanks to the gentlemen named in the ensuing list—to whose activity and punctuality it is owing that the scheme has been realised, and the Work completed in a comparatively short period; and whose zealous coöperation has lightened his labours and made the occupation interesting and pleasant. It would be ungrateful on the part of the Editor not to add that the scheme originated with his friend and colleague Mr. Pollock, and was first brought into actual movement through his influence; and that he has lent most valuable advice and assistance throughout its progress. The heavy pecuniary risks connected with it were undertaken by the late Mr. J. W. Parker jun., mainly in consequence of his interest in a profession in which he had many friends; and the Editor cannot conclude his task without renewed expressions of regret for the loss of one whom he had learned to esteem, and who was esteemed by all (and they were many) with whom he was connected.

LIST OF THE AUTHORS OF THIS WORK AND OF THEIR CONTRIBUTIONS.

NAMES.	SUBJECTS.
A. W. BARCLAY, Esq., M.D. Physician to St. George's Hospital.	Delirium Tremens, vol. i.; Diphtheria and Croup, vol. iv.
J. BIRKETT, Esq. Surgeon to Guy's Hospital.	Injuries of the Pelvis, vol. i.; Hernia, Diseases of the Breast, vol. iv.
B. BRODHURST, Esq. Assistant Surgeon to St. George's Hospital, and to the Royal Orthopædic Hospital.	Congenital Dislocations and intra-uterine Fractures,* vol. iv.
C. E. BROWN-SÉQUARD, Esq., M.D., F.R.S.	Diseases of the Nerves, and Neuroma, vol. iii.
G. BUSK, Esq., F.R.S. Surgeon to the Seamen's Hospital-ship "Dreadnought."	Parasites, and the Diseases which they produce; Venomous Insects and Reptiles, vol. iv.
G. W. CALLENDER, Esq. Assistant Surgeon to St. Bartholomew's Hospital.	Pyæmia, vol. i.; Diseases of the Veins, vol. iii.
HOLMES COOTE, Esq. Surgeon to St. Bartholomew's Hospital.	Abscess, Gangrene, vol. i.; Injuries of the Face, vol. ii.; Plastic Surgery, Diseases of the Tongue, vol. iii.; Diseases of the Thyroid Gland, Surgical Apparatus,† vol. iv.
J. CROFT, Esq. Assistant Surgeon to St. Thomas's Hospital.	Hectic and Traumatic Fever, with the principles of treatment after operation, vol. iv.
C. DE MORGAN, Esq., F.R.S. Surgeon to the Middlesex Hospital.	Erysipelas and the allied Diseases, vol. i.
J. DIXON, Esq. Surgeon to the Royal London Ophthalmic Hospital, Moorfields.	Diseases and Injuries of the Eye, vol. ii.
A. E. DURHAM, Esq. Assistant Surgeon to Guy's Hospital.	The Laryngoscope, vol. iii.
W. H. FLOWER, Esq., F.R.S. Conservator of the Museum at the Royal College of Surgeons.	Injuries of the Upper Extremity, vol. ii.
H. GRAY, Esq., F.R.S. Late Lecturer on Anatomy at St. George's Hospital.	Injuries of the Neck, vol. ii.; Surgical Diseases of the Air-passages, vol. iii.
GEORGE HARLEY, Esq., M.D. Assistant Physician to University College Hospital.	Apnoea, vol. iv.
ERNEST HART, Esq. Ophthalmic Surgeon to St. Mary's Hospital.	Aneurism, vol. iii.‡
CHARLES HAWKINS, Esq. Inspector of Anatomy.	Lithotrity, vol. iv.

* Forming part of the essay on the Surgical Diseases of Childhood.

† In conjunction with Mr. Wordsworth.

‡ The sections on Digital Pressure, Manipulation, Galvano-puncture, Coagulating Injections, Arterio-venous and Cirroid Aneurism.

NAMES.	SUBJECTS.
PRESCOTT G. HEWETT, Esq. Surgeon to St. George's Hospital.	Injuries of the Head, vol. ii.
T. HILLIER, Esq., M.D. Physician to the Hospital for Sick Children.	Diseases of the Skin (a portion), vol. iv.
J. HINTON, Esq. Aural Surgeon to Guy's Hospital.	Diseases of the Ear, vol. iii.
T. HOLMES, Esq. Surgeon to the Hospital for Sick Children, Assistant Surgeon to St. George's Hospital.	Editor. Burns and Scalds, General Pathology of Dislocations, vol. i.; Aneurism,* Diseases of the Bones, Excision of Bones and Joints, vol. iii.; Surgical Diseases of Child- hood,† Surgical Diagnosis, and Regional Surgery, vol. iv.
C. HOLTHOUSE, Esq. Surgeon to the Westminster Hospital.	Injuries of the Lower Extremity, vol. ii.
T. K. HORNIDGE, Esq.	General Pathology of Fractures, vol. i.
G. M. HUMPHRY, M.D., F.R.S. Surgeon to Addenbrooke's Hospital, Cam- bridge.	Diseases of the Male Organs of Gene- ration, vol. iv.
JONATHAN HUTCHINSON, Esq. Surgeon to the London Hospital.	Surgical Diseases of Women, vol. iv.
W. JENNER, Esq., M.D. Physician in Ordinary to her Majesty the Queen, and to his Royal Highness the Prince of Wales; Physician to University College Hospital.	Diseases of the Skin,‡ vol. iv.
ATHOL A. W. JOHNSON, Esq.	Diseases of the Joints, vol. iii.
HENRY LEE, Esq. Surgeon to St. George's Hospital.	Syphilis, vol. i.; Gonorrhœa,§ vol. iv.
J. LISTER, Esq., F.R.S. Professor of Surgery at the University of Glasgow.	Amputation, Anæsthetics, vol. iii.
W. J. LITTLE, Esq., M.D.	Orthopædic Surgery, vol. iii.
T. LONGMORE, Esq. Deputy-Inspector-General and Professor of Clinical and Military Surgery, New Army Medical School, Royal Victoria Hospital, Netley, Southampton.	Gunshot Wounds, vol. ii.
JEFFERY A. MARSTON, Esq., M.D. Surgeon, Royal Artillery.	Gonorrhœa, vol. iv.
SIR J. RANALD MARTIN, C.B., F.R.S. Examining Medical Officer to the Secretary of State for India in Council.	Hospitals, vol. iv.
C. H. MOORE, Esq. Surgeon to the Middlesex Hospital.	Cancer, Wounds of Vessels, vol. i.; Diseases of the Absorbent System, Atheroma and Obstruction of the Arteries, vol. iii.
J. PAGET, Esq., F.R.S. Surgeon Extraordinary to her Majesty the Queen; Surgeon in Ordinary to his Royal Highness the Prince of Wales; Surgeon to St. Bartholomew's Hospital.	Sinus and Fistula, Ulcers, Innocent Tumours, Contusions, Wounds, vol. i.

* Except the portions by Mr. Hart.

† Except the portions by Mr. Brodhurst and Mr. Shaw.

‡ Except the sections by Dr. Hillier.

§ In conjunction with Dr. Marston.

|| In conjunction with Mr. Lee.

NAMES.	SUBJECTS.
A. POLAND, Esq. Surgeon to Guy's Hospital.	Tetanus, Animal Poisons, vol. i.; Injuries of the Chest, vol. ii.; Calculus, Lithotomy, vol. iv.
G. D. POLLOCK, Esq. Surgeon in Ordinary to his Royal Highness the Prince of Wales; Surgeon to St. George's Hospital.	Injuries of the Abdomen, vol. ii.; Diseases of the Mouth and Alimentary Canal, vol. iv.
S. JAMES A. SALTER, Esq., F.R.S. Surgeon-Dentist to Guy's Hospital.	Surgical Diseases connected with the Teeth, vol. iv.
W. S. SAVORY, Esq., F.R.S. Assistant Surgeon to St. Bartholomew's Hospital.	Scrofula, Hysteria, Collapse, vol. i.
A. SHAW, Esq. Surgeon to the Middlesex Hospital.	Injuries of the Back, vol. i.; Disease of the Spine, vol. iii.; Lateral Distortion of the Spine,* vol. iv.
J. SIMON, Esq., F.R.S. Surgeon to St. Thomas's Hospital; Medical Officer of the Privy Council.	Inflammation, vol. i.
H. SMITH, Esq. Assistant Surgeon to King's College Hospital.	Diseases of the Rectum, vol. iv.
T. SMITH, Esq. Assistant Surgeon to St. Bartholomew's Hospital, and to the Hospital for Sick Children.	Minor Surgery, vol. iii.; Local or Surgical Affections of the Skin and its Appendages, vol. iv.
T. TATUM, Esq. Surgeon to St. George's Hospital.	Affections of the Muscular System, vol. iii.
H. THOMPSON, Esq. Surgeon to University College Hospital.	The Surgery of the Male Urinary Organs, vol. iv.
A. URE, Esq. Surgeon to St. Mary's Hospital.	Diseases of the Nose, vol. iii.
J. C. WORDSWORTH, Esq. Surgeon to the Royal London Ophthalmic Hospital, Moorfields.	Surgical Apparatus,† vol. iv.

* In the essay on the Surgical Diseases of Childhood.

† In conjunction with Mr. Holmes Coote.



NOTE.

IN anticipation that the fourth volume of this Work would have speedily followed its predecessors, Mr. Salter's essay on the "Surgical Diseases connected with the Teeth" was finally committed to the press in June 1862. It is necessary to make this statement, as some original observations, and literary references to the recent writings of others, are omitted in the article in question, which would have appeared had it been open to addition and correction till the present time.

The writers of the essay on Gonorrhoea have requested the Editor to append the following foot-note, which was accidentally omitted from their manuscript. It ought to have come after the paragraph on p. 632, ending "may be the result of other than specific pus."

"See also Bumstead's *Treatise on Venereal Diseases*, 1861, to which the writers are much indebted."

Also add the same reference at p. 635, after the paragraph ending "urethra."

CONTENTS OF THE FOURTH VOLUME.

SURGICAL DISEASES CONNECTED WITH THE TEETH.

By S. JAMES A. SALTER, ESQ.

SURGEON-DENTIST TO GUY'S HOSPITAL.

	PAGE
Subjects comprised in this essay	1
I. Alveolar abscess	2
Gumboil	3
Pointing of alveolar abscess inside the mouth	4
" " remote from the origin of the abscess	5
" " on the face	7
Diagnosis of alveolar abscess	8
Treatment	9
II. Painful and difficult eruption of wisdom-teeth	9
In the upper jaw	10
" lower "	10
Spasmodic contraction of masseter	11
Suppuration and fistulæ from this cause	12
Treatment	14
" of the spasmodic closure of the mouth	14
III. Tumours of the gum and tooth-pulp:	
Epulis	15
Treatment.	17
Congenital hypertrophy of the gum and alveoli	18
Polypus of the gum	20
Vascular tumours	22
Polypus of the tooth-pulp	23
Sensitive growth of pulp after fracture	24
IV. Abscess of the antrum	25
Varying extent of the antrum	25
Cause and symptoms of antral abscess	26
Treatment	28
V. Dentigerous cysts	32
Pathology and mode of development	32
Causes of impaction of teeth	33
Summary of the recorded cases of such cysts	34
Symptoms	37
Treatment	38

	PAGE
VI. Alveolar and maxillary necrosis (a) from phosphorus	39
Causes of this affection	41
Symptoms	43
Treatment	47
(b) Exanthematous jaw-necrosis	50
VII. Hæmorrhage after extraction of teeth	53
Treatment	55
VIII. On the application of obturators and false palates in cleft palate, &c.	57

DIPHTHERIA AND CROUP.

By A. W. BARCLAY, M.D.

PHYSICIAN TO ST. GEORGE'S HOSPITAL.

DIPHTHERIA:

Relations of diphtheria to croup and scarlatina	60
History	61
Symptoms	62
Definition of diphtheria	64
Albuminuria	64
Paralysis	65
Diphtheritic fever	65
The fibrinous exudation	68
Treatment	70
Tracheotomy in diphtheria	71
Ordinary sore-throat occurring in epidemics of diphtheria	71

CROUP:

General characters	72
Diagnosis	73
Treatment	75
Tracheotomy in croup	76

DISEASES OF THE MOUTH AND ALIMENTARY CANAL.

By G. D. POLLOCK, ESQ.

SURGEON TO ST. GEORGE'S HOSPITAL.

OF THE MOUTH:

Quinsey—Acute inflammation of the tonsils	77
Causes of this inflammation	78
Treatment of quinsey	78
Diagnosis from other inflammatory affections in this region	80

	PAGE
Chronic enlargement of the tonsils	81
Causes of enlarged tonsils	82
Effects "	82
Pathological anatomy	83
Treatment	83
Excision of the tonsils	84
Malignant sore-throat (tonsillitis maligna)	85
Ulcerated sore-throat	86
Relaxed uvula	87
Removal of the uvula	87
Tumours of the palate	87
Cleft palate (congenital)	88
Its mode of origin—development of the mouth	88
Classification and description of different degrees	89
Varying width of the cleft	92
Symptoms of cleft palate	92
Adaptation of an artificial septum	93
Question of operating in infancy	94
Operation in cases of bifid uvula	94
" " cleft of the soft palate	95
" " different methods of dividing the muscles	96
" " cleft of the hard and soft palate	99
Treatment of acquired openings in the palate	103
After treatment of cases of staphylorrhaphy	104
Improvement in speech after operation	106

OF THE LIPS :

Cracked lips	106
Aphthous ulceration	108
Nævus of the lips and cheeks	108
Cancer of the lip	110
Diagnosis from chancre	111
Treatment	111
Caustics in cancer of the lip	112
Cysts of the lip	113
Congenital cysts of the mouth	114
Other forms of cyst in this region	115
Treatment of these cysts	116
Tongue-tie	118

TUMOURS OF THE JAW :

Cartilaginous tumours	120
Cystic tumours	120
Fibrous tumours	122
Recurrence of fibrous tumour	125
Myeloid tumours	126
Bony tumours	127
Hypertrophy of the bones of the face	128
Vascular tumours of the bones of the face	130
Cancerous tumours	130

Treatment of obstruction	175
Colotomy	176
Cases in which colotomy is justifiable	176
Not justifiable in intussusception	176
Insufflation and injection in intussusception	177
Indications and contra-indications to colotomy in its various forms	178
Opening the peritoneal sac (Littre's operation)	179
Lumbar colotomy (Amussat's and Calissen's operations)	180
Paracentesis of the abdomen	181

DISEASES OF THE RECTUM.

By H. SMITH, ESQ.

ASSISTANT-SURGEON TO KING'S COLLEGE HOSPITAL.

Hæmorrhoids	183
External hæmorrhoids	183
Their anatomy	184
Treatment	185
Internal hæmorrhoids	186
Various forms, and structure of each	187
Treatment of internal piles	189
Ligature	190
Nitric acid	192
Clamp and cautery	193
Ecraseur	194
Prolapsus of the rectum	194
Various conditions—complicated with piles	195
Treatment	196
Fistula in ano	199
Formation of fistula	199
Various forms of fistula—complete and incomplete	200
Horseshoe fistula	201
Causes and diagnosis of fistula	201
Treatment of fistula	202
Operation for fistula	203
Ulcer of the rectum and anus	206
Treatment	208
Fissure of the anus	210
Stricture of the rectum (simple)	211
Anatomy	211
Symptoms	212
Diagnosis	214
Causes	215
Treatment	215
Colotomy	218

	PAGE
Cancer of the rectum	218
Symptoms	219
Diagnosis and treatment	220
Polypus of the rectum	221
Various forms,—gelatinous, fibrous, and fibro-cellular, warty and vascular	222
Treatment	223
Pruritus ani	224
Treatment	225
Neuralgia of the rectum and its treatment	226

HERNIA.

By J. BIRKETT, ESQ.

SURGEON TO GUY'S HOSPITAL.

PART I.

PATHOLOGY AND TREATMENT OF HERNIA IN GENERAL.

General considerations.	Proportions of the two sexes	227
	Frequency of hernia at different ages	227
	Proportion of population affected with hernia	228
	Influence of occupation	229
	Influence of hereditary conformation and other circumstances	229
	Immediate cause of hernia	231
Symptoms of hernia in general		231
Prognosis		232
Nomenclature of hernia		233
The essential parts of the tumour		233
The inciting causes of hernia		233
Congenital patency of the vaginal process of the peritoneum		234
Description of the changes which take place in this process		235
Condition of the vaginal process at birth		236
Of the gradual development of the hernial sac		237
The period of formation		237
" " organisation		238
" " contraction		238
The two kinds of hernial sac, congenital and acquired		239
The treatment of reducible hernia—palliative measures		240
Trusses		241
Radical cure of hernia		242
Morbid conditions of the hernia		246
Permanent irreducibility		246
Obstruction or distension		247
Inflammation		247
Strangulation		248
Immediate cause		248
Structural changes		250

	PAGE
Gangrene	250
Ulceration in the line of the stricture	251
Liability of recent hernia to acute strangulation	251
Morbid conditions produced by manual force	252
Artificial anus	252
Morbid conditions of the coverings of the hernia	253
Characters of the serum in the sac	254
Constitutional symptoms induced by the morbid state of the alimentary canal above	255
Effects of obstruction	255
Constitutional symptoms of strangulation	256
Necessity of searching for hernial tumours in cer- tain cases	257
Nature of the vomit	257
Symptoms of prostration	258
" peritonitis	258
" collapse	259
Pain as a symptom in strangulated hernia	259
Prognosis of strangulated hernia before operation	259
Necessity for liberating the bowel as soon as possible	261
Treatment of irreducible hernia	262
Injurious effects often produced by the taxis	262
Treatment before vomiting commences	263
Method of applying the taxis	264
Treatment during the stage of vomiting	264
The use of chloroform	265
Symptoms of rupture of the bowel by taxis	266
Cold applications	267
Purgatives and enemata	268
Other means of treatment	268
Injuries inflicted on the hernia—by the taxis	268
" " by accident	269
Injuries of the sac—by displacement	270
" " by laceration	271
Injuries of the coverings of the sac	271
Intra-parietal sacs	272
The operation for strangulated hernia—general considerations	272
Description of the operation	273
On opening the hernial sac	276
The instruments required in the operation	278
Treatment of the strangulated intestine	279
Perforation and wound of the gut	280
Difficulties in reduction—from bulk of intestine	280
" " " adhesions	281
" " " depth of mouth of sac	281
Treatment of the omentum	282
" " cases of double hernia	283
" " the case after operation	283
" " the wound	286
Prognosis of operations for strangulated hernia	286

PART II.

SPECIAL KINDS OF HERNIA.

	PAGE
Classification	288
Hernia in the epigastric region.	288
" mesogastric " 	288
Diaphragmatic	288
Epigastric	288
Ventral	289
Umbilical	289
Radical cure	290
Operation	291
Lumbar	291
" hypogastric " 	281
Inguinal, its proportion to femoral hernia	281
Oblique, its varieties	292
Hernia into the vaginal process	292
Hernia into the funicular portion of the vaginal process	295
Frequency of these forms of hernia	297
Hour-glass contraction of the sac of oblique inguinal hernia	298
Infantile hernia	302
Inguinal-scrotal hernia of slow formation	302
Table of characteristics of the three varieties of oblique hernia	304
Diagnosis of tumours of the scrotum	305
Table of diagnostic characters	306
Radical cure of reducible inguinal hernia	308
The taxis	309
The operation	310
Oblique inguinal hernia in the female	310
Direct inguinal hernia	311
Abnormal inguinal hernia	312
Femoral or crural hernia	312
Varieties	313
Development of its sac	313
Diagnostication	314
Trusses	315
Frequency with reference to sex, age, and pregnancy	315
Morbid conditions	317
The taxis	318
The operation	318

	PAGE
Wound of the obturator artery	319
Obturator hernia	319
Analysis of recorded cases	320
Diagnosis	323
Treatment and operation	325
Perineal hernia	325
Pudendal, vaginal, and ischiatic hernia	326

THE SURGERY OF THE MALE URINARY ORGANS.

By H. THOMPSON, Esq.

SURGEON TO UNIVERSITY COLLEGE HOSPITAL.

General considerations	327
DISEASES OF THE KIDNEYS:	
Malformations	329
Nephritis—acute	329
Diagnosis and description of other similar affections, viz.	
Calculous nephralgia	330
Acute calculous pyelitis	331
Perinephritis: caries of spine	331
Rheumatic affection—lumbago	331
Renal neuralgia	331
Acute cystitis	332
Calculus of the bladder	332
Treatment of acute nephritis	332
" " calculous nephralgia and pyelitis	333
Abscesses of kidney	333
Chronic nephritis	334
Hæmaturia	334
Treatment of its various forms	336
Suppression of urine	337
Malformations and other affections of the ureters	337
DISEASES OF THE BLADDER:	
Malformations. Deviation of the ureters	338
" Multiple bladder	338
" Extroversion of the bladder	339
" Treatment	339
Classification of the diseases of the bladder	340
I. Conditions involving structural change:	
Acute cystitis—anatomy	341
" " causes	342
" " symptoms	342
" " Treatment	343
Chronic cystitis	343
" " with increased secretion (catarrh)	345
Treatment. 1. Topical	345
2. Internal	346

	PAGE
Suppuration of the bladder	348
Abscess in the walls of the bladder	348
Ulceration of the bladder	348
Vesico-intestinal fistula	348
Hypertrophy and sacculation: dilatation, &c.	349
Vesical hæmorrhage (see Hæmaturia).	
Tumours of the bladder:	
1. Fibrous tumours	350
2. Villous growths	351
3. Malignant tumours	351
Symptoms and treatment	352
Tubercle of the bladder	353
Bar at the neck of the bladder	353
Hernia of the bladder	354
Inversion " "	354
II. Conditions not necessarily involving structural change:	
Paralysis of the bladder	355
Atony from over-distension	356
Irritable bladder	357
Spasm of the bladder	357
Perverted sensibility and neuralgia	358
Incontinence of urine in youth	359
" " the adult	359
Habitual engorgement and overflow of urine	360
Retention of urine (see Stricture).	
DISEASES OF THE PROSTATE GLAND:	
Malformations	361
Acute inflammation	361
Chronic inflammation	363
Abscess of the prostate	363
Chronic enlargement (hypertrophy) of the prostate	365
Anatomy	365
Symptoms	367
Diagnosis	370
Prostatic catheter	371
Beaked sound	372
Treatment of retention of urine and distention of the bladder	
from this cause	374
General treatment	375
Treatment of the enlarged prostate itself	376
Atrophy of the prostate	377
Malignant disease of the prostate	377
Tubercle of the prostate	379
Cysts in the prostate	380
Hydatids in and near the prostate	381
DISEASES OF THE URETHRA. Division of the subject	381
Congenital aberrations and malformations:	
1. Absence of the urethra	382
2. Congenital occlusion	382
3. Epispadias and hypospadias	382
4. Other malformations	382

Contractions of the urethra (stricture):	383
Organic or permanent	
Anatomical classification: viz.	383
Linear stricture	384
Annular	384
Indurated annular	384
Irregular or tortuous	384
Number in one urethra	384
Origin, nature, and seat of stricture	385
Obstructions from false membranes	385
Degree of contraction	385
Locality of stricture	386
Causes of organic stricture	388
Symptoms—Local	389
" Retention and engorgement	390
" Constitutional	
Strictures classified according to their symptoms, as simple, sensitive or irritable, and contractile or recurring	391
Diagnosis of stricture	391
Method of passing the catheter	392
Treatment of stricture—gradual dilatation	395
False passages	396
Chloroform in dilatation of stricture	397
Continuous or permanent dilatation	397
Dilatation by mechanical means—forcible	398
Holt's and Thompson's instruments for this purpose	399
Constitutional treatment	400
Treatment by caustics.	400
Incision. 1. Internal urethrotomy	401
From before backwards	402
From behind forwards	403
2. External urethrotomy	405
Perineal section	405
External division (Syme's operation)	405
Results of external urethrotomy	406
Spasmodic stricture	407
Inflammatory "	409
Tumours in the urethra	409
Urinary abscess	410
Urinary fistula	412
" " Treatment. Urethroplasty	415
Retention of urine	416
Treatment	418
Forced catheterism	418
Perineal incision	418
Puncture of the bladder by the rectum	418
" " above the pubes	419
" " through the pubic symphysis	419
Treatment of retention from enlarged prostate	420
Extravasation of urine	421
Treatment	422
Rupture of the bladder from obstruction	422

URINARY CALCULI AND LITHOTOMY.

By A. POLAND, ESQ.

SURGEON TO GUY'S HOSPITAL.

	PAGE
The sources of morbid deposits in the urine	424
Urinary deposits. Uric acid	425
The urates, uric oxide	426
The oxalates	426
Cystic oxide	427
Phosphatic deposits	427
Carbonate of lime	428
Formation of calculus	428
Immediate causes of its formation	429
Classification of calculi	430
Physical characters of calculi	431
Characters on section	432
Chemical tests for calculi	434
Kinds of calculus. 1. Uric acid	435
2. Urate of ammonia	436
3. Uric, or xanthic oxide	436
4. Oxalate of lime	436
5. Cystic oxide	438
6. Phosphate of lime	439
7. Triple phosphate	439
8. Fusible calculus	440
9. Carbonate of lime	440
10. Fibrinous calculus	441
11. Urostealith	441
12. Blood-calculi	441
Predisposing causes of calculus	442
Sex and age. Statistics	442
Other predisposing causes	444
Calculus in the bladder. Symptoms	444
Sounding for stone	447
Prognosis of stone in the bladder	449
The natural progress of a case to its fatal termination	449
Treatment. General	450
Lithontriptics	451
Electrolysis	452
Lithotomy. Perineal	453
Instruments and preliminary precautions	453
Steps of the ordinary lateral operation	455
Aston Key's operation with the straight staff	456
Accidents and difficulties of lateral lithotomy	
1. In cutting into the bladder	457
2. In extracting the stone	459
Causes of death after lateral lithotomy	460
Statistics of " "	461

	PAGE
Mortality at different ages	462
Statistics of the Norwich Hospital	462
Table of cases of recurrence of stone after lithotomy at the Norwich Hospital, with remarks by Mr. Williams	463
Different modes of performing perineal lithotomy	465
Boyer's method with the <i>lithotome caché</i>	466
Dupuytren's bilateral operation	466
Median lithotomy. The Marian operation; Civiale's medio-bilateral operation; Buchanan's operation; Allarton's operation	467
Vidal de Cassis' quadrilateral section	467
The recto-vesical operation	467
The hypogastric operation	468
Estimate of the different methods	470
Statistics of the median operation at Norwich, with remarks by Mr. Williams	472
Calculus in the prostate gland	473
Symptoms and diagnosis	474
Treatment	474
Calculus in the urethra	475
Treatment	475
Calculus in the female bladder	476
Various methods of treatment	476
Lithotomy in the female	476

LITHOTRITY.

By CHARLES HAWKINS, ESQ.

INSPECTOR OF ANATOMY.

History of the invention of lithotritry	478
Preliminary treatment	479
The operation. Methods of seizing the stone	480
Sir B. Brodie's method	481
M. Civiale's method	483
Completion of the operation	483
Repetition of operation	484
Complications after operation	486
Use of chloroform in lithotritry	486
Question of lithotomy or lithotritry	488
Comparative mortality of lithotomy and lithotritry	490
Lithotritry in hospital practice	490

SURGICAL DISEASES OF WOMEN.

By J. HUTCHINSON, ESQ.

SURGEON TO THE LONDON HOSPITAL.

	PAGE
Urethral hæmorrhoids, or vascular tumours of the meatus . . .	491
Malformations of the vagina: adhesion of the labia . . .	492
Imperforate hymen, occlusion of the vagina, absence of uterus	493
Operations for these malformations . . .	494
Dangers of these operations, and causes of death . . .	495
Uterine polypus; its varieties . . .	497
Recurrent fibroid tumour of the uterus . . .	498
Operations for uterine polypus . . .	498
Surgical treatment of fibroid tumours of the uterus . . .	500
Primary enucleation . . .	501
Enucleation by inducing gangrene . . .	502
Natural progress of fibroid tumours . . .	504
Conclusions on the subject of the surgical treatment of these tumours . . .	505
Cancer of the uterus in reference to surgical treatment . . .	506
Excision of cancer of the cervix uteri . . .	508
Malignant disease of the external genitals . . .	510
Non-malignant diseases " " . . .	511
Surgical measures in extra-uterine pregnancy . . .	512
Operations for rupture of the perineum and its consequences . . .	515
Surgical measures in prolapsus uteri . . .	516
Description of these operations . . .	517
Organic diseases of the ovary . . .	518
Solid growths . . .	519
Cysts in the broad ligament . . .	519
Cystic diseases of the ovary, simple and proliferous . . .	520
Dermoid cysts . . .	521
Relative frequency of these various forms . . .	521
Age at which ovarian disease occurs . . .	522
Rate of progress . . .	522
Accidental or spontaneous cure . . .	523
Treatment,—by repeated tapping . . .	524
by pressure . . .	524
by establishing a fistula . . .	524
by injection . . .	525
by ovariectomy . . .	525
Description of the operation . . .	526
After treatment . . .	527
Traumatic peritonitis after ovariectomy . . .	527
Management of the wound . . .	528
Question of long or short incision . . .	529
Treatment of adhesions . . .	529
Treatment of multilocular cysts . . .	530

Prevention of escape of cyst-fluid into the abdominal cavity	530
Management of the pedicle. The clamp	530
Closing of the wound	532
Reasons for the greater frequency of ovariectomy of late	532
Probable average success of ovariectomy	533
The advantages of ovariectomy, as shown by statistics	534
Errors in diagnosis of ovarian tumours	535
Fistula communicating with the vagina or uterus	536
Operation for vesico-vaginal fistula	537
„ „ recto-vaginal „	538

DISEASES OF THE MALE ORGANS OF GENERATION.

By G. M. HUMPHRY, M.D.

SURGEON TO ADDENBROOKE'S HOSPITAL, CAMBRIDGE.

AFFECTIONS OF THE TESTICLE:

Failures in development of the testicle	539
Congenital absence of the testicle or vas deferens	540
Retention of the testicle	541
Condition of the retained testis	542
Diseases of the retained testis	543
Complication with hernia	544
Misplacement of testicle	545
Persistence of the canal between the tunica vaginalis and peritoneum	546
Imperfect development of the testis after its passage into the scrotum	546
Inversion of the testis	547
Hydrocele	547
Position of the testis	548
Condition of the testis	549
Varieties of hydrocele	549
Tubular prolongation to abdomen (congenital hydrocele)	550
Diagnosis of hydrocele	551
Symptoms „ „	553
Treatment by tapping	554
by injection	554
by acupuncture, nitric oxyde of mercury, wire seton, and incision	556
Spontaneous cure	556
Infantile hydrocele	557
Encysted hydrocele—small and large cysts	557

	PAGE
Spermatozoa in encysted hydrocele	559
Diagnosis	560
Treatment	561
Hydrocele of the spermatic cord	561
Diagnosis	562
Illustrative cases	562
Diffused hydrocele of the cord	563
Hæmatocele	564
Diagnosis and treatment	565
Encysted hæmatocele	566
Fibrous and cartilaginous bodies in the tunica vaginalis	567
Inflammation of the testicle (orchitis)—acute	568
in infants	570
Epididymitis, gonorrhœal, &c.	570
Treatment	573
Chronic orchitis (including syphi- litic disease)	573
Suppuration	576
Hernia testis	577
Diagnosis and treatment	578
Scrofulous orchitis	580
Affecting the epididymus	581
" " body of the testis	582
Tubercles in the testis	583
Reparative processes	584
Diagnosis	585
Treatment	586
Cystic disease	587
Diagnosis and treatment	589
Association with malignant disease	590
" " enchondroma	591
Fibrous and other innocent tumours of the testicle	593
Cancer of the testicle	594
Symptoms and diagnosis	596
Treatment	598
Calcareous, osseous, and other formations in the testicle	599
Treatment	600
The operation of castration	601
Functional disorders of the testicle	603
Consequences of masturbation	603
Nocturnal emissions	604
Treatment of these disorders	605
Castration in erotomania	606
Impotence from spermatorrhœa	607
" " injury, cerebral malformations, &c.	609
Atrophy of the testis	609
Irritable and neuralgic testicle	610
Varicocele	612
Treatment	613
Tumours of the cord	615
AFFECTIONS OF THE VESICULÆ SEMINALES	615

	PAGE
AFFECTIONS OF THE SCROTUM:	
Edema	617
Inflammation	618
Elephantiasis	618
Treatment—operation	619
Tumours of the scrotum	620
Calculi in the scrotum	620
Chimney-sweep's cancer	621
Treatment	622
AFFECTIONS OF THE PENIS:	
Gangrene	622
Cancer	623
Circumcision for cancer of penis	624
Amputation of the penis	624

GONORRHOEA.

By H. LEE, ESQ.

SURGEON TO ST. GEORGE'S HOSPITAL; AND

J. A. MARSTON, ESQ., M.D.

SURGEON, ROYAL ARTILLERY.

History of the disease	626
Pathology	627
John Hunter's experiment on himself	627
Causes of urethritis	630
Doctrine of "mediate contagion"	632
Seat and progress of gonorrhœa	633
Gonorrhœa in the male	
The premonitory stage	634
The inflammatory stage	635
Chordee	635
The stage of decline	636
Gleet	636
Pathology of gleet	637
Varieties of the disease. Gonorrhœa sicca. Balanitis	638
Complications. Irritation of the urinary organs	638
Hæmorrhage from the urethra	639
Lacunar abscess	639
Bubo and lymphatic inflammation	639
Phimosis	640
Operations for phimosis, circumcision	641
Paraphimosis	642
Chronic inflammation of the prostate	643
Erythema	644
Herpes præputialis	644
Epididymitis	645

	PAGE
Diagnosis of gonorrhœa	645
Treatment. First stage,—abortive treatment	645
Second, or acute stage	646
Copaiba rash	647
Third stage (stage of decline)	647
Injections	648
Question of the value of copaiba and cubebs	649
Gleet	650
Gonorrhœa in the female	650
Complications, peritoneal and ovarian inflammation, abscess of the labia	652

DISEASES OF THE BREAST.

By J. BIRKETT, ESQ.

SURGEON TO GUY'S HOSPITAL.

Anatomy of the breast	653
Anomalies in number and position of the breasts	654
Peculiarities in the anatomy of the rudimentary organ	655
" " of the breast at puberty	655
Anatomy of the nipple and areola	656
" the glands of the areola	657
Peculiarities in the anatomy of the breasts after puberty	657
" " " after uterine conception	658
" " " after parturition and during lactation	659
Plan of the nerves of the breast	659
The arteries and veins	660
General observations on the diagnosis of diseases of the breast	660
General therapia in the healthy condition at the various crises of female life	663
" " in disease. Support and compression	664
" " " Injection of sinuses	665
" " " Amputation of the breast	665
Special diseases. Division I. Morbid conditions of the tissues composing the breast:	666
Hypertrophy	667
Atrophy	668
Inflammation and its results. During infancy	668
" " " At puberty	669
" " " During pregnancy and lactation	670
Semciology and progress of inflammation	670
Mammary abscess	671
Treatment of inflammation	672
On opening abscesses	673
Chronic induration	675
Effusions of blood from contusion	675

	PAGE
Hyperæsthesia (irritable mamma)	675
Functional disorders. Abnormal secretion; agalactia; galactorrhœa; congestion with milk	675
Special diseases. Division II. New growths, forming tumours, the elements of which more or less resemble those composing the gland.	
Adenocœle,—its anatomy and varieties	677
Symptoms and progress	678
Recurrence and alternation of these growths after removal	679
Diagnosis and treatment	680
Duct-cysts	680
Galactocœle	682
Sero-cysts	682
Lipoma and excess of fat	683
Vascular growths	684
Neuromata	684
Enchondroma and osteoid growths	684
Special diseases. Division III. New growths composed of elements foreign to the normal tissues of the body:	
Hydatid cysts	685
Fibro-plastic growths	685
Colloid growths	685
Carcinoma. Its varieties	686
„ Age at which it is usually developed	688
Symptoms and progress	688
Treatment. Question of operation	691
Special Divisions. Division IV. Diseases of the nipple, areola, sinuses, and sebaceous glands:	
Deficiency of the nipple, bifid nipple, &c.	693
Inflammation and cracks of the nipple	693
Hyperæsthesia of the nipple	694
Inflammation and abscess of the areola	694
New growths	694
Special diseases. Division V. Diseases of the male mammilla	694

DISEASES OF THE THYROID GLAND.

By HOLMES COOTE, ESQ.

SURGEON TO ST. BARTHOLOMEW'S HOSPITAL.

General observations on the thyroid body and on the question of the possibility of extirpating it	696
Bronchocœle	697
Endemic bronchocœle, or goître	697
Its geographical distribution and causes	697
Treatment of bronchocœle	699

	PAGE
Ligature of the thyroid arteries	699
Strychnia, setons, &c.	700
Tracheotomy in enlarged thyroid	701
Enlargement of the thyroid in pregnancy	701
Pulsating, or exophthalmic bronchocele	702
Pathological anatomy	703
Treatment	705
Acute inflammation of the thyroid body	706
Cancer of the thyroid body	707

DISEASES OF THE SKIN.

PART I.

GENERAL OR CONSTITUTIONAL AFFECTIONS.

By DR. JENNER,

PHYSICIAN TO UNIVERSITY COLLEGE HOSPITAL; AND

DR. HILLIER,

PHYSICIAN TO THE HOSPITAL FOR SICK CHILDREN.

Classification of the constitutional affections of the skin	709
EXANTHEMATA. Roseola	713
Erythema	714
Varieties. Local	714
Constitutional	715
Urticaria	717
Varieties; local, acute, and chronic	717
HÆMORRHAGIA. Purpura	719
Scorbutus	719
VESICULÆ. Sudamina	720
Miliaria	720
Eczema	721
Varieties. E. impetiginodes	723
Herpes	723
Varieties. H. zoster	724
H. iris	724
H. circinnatus	725
PARASITICI. Tinea. T. tonsurans	727
T. favosa	729
T. decalvans	730
T. sycosis, or mentagra	731
Chloasma, or pityriasis versicolor	732
Scabies	733
BULLÆ. Pemphigus, or pompholyx	734
Varieties	736
Rupia	737
PUSTULÆ. Impetigo	737

	PAGE
Varieties	737
Porrigo, meaning of this term of Willan	738
Ecthyma	739
PAPULÆ. Strophulus	740
Lichen	741
Varieties	741
Prurigo	743
Local prurigo	744
SQUAMÆ. Pityriasis	745
Psoriasis	745
Varieties. Lepra	745
TUBERCULA. Acne	747
A. rosacea	748
A. sebacea	749
Molluscum	750
Lupus	750
L. exedens	751
L. non-exedens	752
Cancer of the skin	753
Elephantiasis Græcorum	753
E. Arabum (Barbadoes leg)	755
Framboesia, or Yaws	756
Kelis, or Keloid	756
Eiloid and Lepoid	758
MACULÆ. Excess of pigment	758
Addison's disease	759
Moles	759
Want of pigment. Albinism	759
Vitiligo	760
Silver stain	760
XERODERMATA. Ichthyosis simplex	760
Ichthyosis cornea, or hystrix	760
DISEASE OF THE HAIRS. Plica polonica	761

PART II.

LOCAL OR SURGICAL AFFECTIONS OF THE SKIN AND ITS APPENDAGES.

By T. SMITH, ESQ.

ASSISTANT-SURGEON TO ST. BARTHOLOMEW'S, AND TO THE HOSPITAL FOR SICK CHILDREN.

Corns	762
Varieties. Hard, fibrous, and soft	763
Treatment	765
Bunions	766
Warts	769
Varieties of warts	769
Causes	770
Progress and treatment	771

	PAGE
Horns	772
Origin of horns	773
Treatment	774
Boil	774
Ordinary and blind boils	775
Cadaveric boils	776
Constitutional causes	777
Effects of boils	778
Treatment	779
Carbuncle	781
Seat of carbuncle	782
Progress	783
Treatment by incision	784
" by caustic	784
" expectant—pressure	785
Malignant or facial carbuncle	786
Malignant pustule or 'charbon'	789
Treatment	792
Chilblain	792
Its three kinds or degrees	793
Diurnal exacerbations	793
Usual situations	793
Treatment	794
Diseases of the nails—Onychia maligna	795
Syphilitic onychia	795
Psoriasis of the nails	795
Ingrown toenail	795
Evulsion of nail	796

APPENDIX.

SURGICAL DISEASES OF CHILDHOOD.

By T. HOLMES, Esq.

SURGEON TO THE HOSPITAL FOR SICK CHILDREN, AND ASSISTANT-SURGEON TO
ST. GEORGE'S HOSPITAL :

INCLUDING

CONGENITAL DISLOCATION AND INTRA-UTERINE FRACTURE,

By B. BRODHURST, Esq.

ASSISTANT-SURGEON TO ST. GEORGE'S HOSPITAL ;

AND

LATERAL DISTORTION OF THE SPINE,

By A. SHAW, Esq.

SURGEON TO THE MIDDLESEX HOSPITAL.

	PAGE
Preliminary observations—operations in childhood	799
Use of anæsthetics in childhood	801
MALFORMATIONS. Table of malformations	802
Attached foetus—joined twins	802
Parasitic foetus—attached	803
" " " operations for	804
" " included	805
Congenital sacral tumours—coccygeal tumour	805
" " cysts	805
" " caudal lipomata	805
Congenital malformations of the face	806
Spina bifida—Anatomy	807
Symptoms	808
Treatment	808
" tapping and pressure	809
" iodine injection	810
" ligature	810
" excision	811
False spina bifida	811
Imperforate rectum—divided into imperforate anus properly so called, and imperforate rectum in the narrower sense	812
Imperforate anus—1. simple membranous obstruction	813
2. deficiency of lower end of rectum	813
3. rectum ending in vagina	814
4. rectum ending in male urinary tract	815
5. rectum ending in a fistula	815
Imperforate rectum—1. membranous obstruction	816
2. deficiency of upper end of rectum	816

	PAGE
State of the chest	844
The hump	845
Inequality of the shoulders	845
Shape of the waist	846
State of the pelvis	847
Causes—suppleness of the spine and weakness of the muscles	848
Consequent deterioration of bones and ligaments	848
Loosening of the joints from stooping	848
Mechanism—Lumbar curve the first	848
Effect of standing on one leg	849
Wasting of oblique processes	849
Contortion	850
Formation of dorsal curve	851
Accommodation of surrounding structures	852
Diagnosis	852
From rickets	853
Interruption of growth by rickets	853
Form of infant's head contrasted with adult	854
" " body " "	854
Proportion of cranium to face in rickets	855
" " upper to lower part of body in rickets	855
Undergrowth of pelvis in rickets	855
Converse relative proportions in giants	856
Prognosis of lateral curvature	856
Fallacy in estimating the curves	857
Treatment—Preventive	858
By exercises	858
Methods of extending the spine	859
*Pigeon-breast deformity	859
Causes	861
Treatment	861

ON SURGICAL FEVER:

COMPRISING THE PATHOLOGY AND TREATMENT OF HECTIC AND TRAUMATIC
FEVER, AND THE TREATMENT OF CASES AFTER OPERATION.

By J. CROFT, ESQ.

ASSISTANT-SURGEON TO ST. THOMAS'S HOSPITAL.

Hectic fever—Symptoms	861
Etiology	863
Pathology	863
Treatment	864
Book-references	865

	PAGE
Traumatic fever—Symptoms	865
Duration	865
Treatment	866
Book-references	867
On the management of patients after operation :	
The simplicity of modern practice compared with ancient	867
Management of the wound at the time of operation	869
Principles of dressing wounds	869
Other particulars of local treatment	869
Attention to the state of the patient's room	869
" " diet	870
Special symptoms calling for treatment—Shock	870
" " " Faintness and exhaustion	870
" " " Sickness after chloroform	871
" " " Retention of urine	871

APNŒA.

By G. HARLEY, M.D.

ASSISTANT-PHYSICIAN TO UNIVERSITY COLLEGE HOSPITAL.

Reasons for discarding the term 'asphyxia'	872
Necessity for uninterrupted respiration—falsehood of the stories of its temporary suspension	872
Symptoms of apnœa	873
Occasional difficulty of diagnosis in consequence of deception	873
Post-mortem appearances—external—rigor mortis	874
" " of internal organs—the brain	874
" " " " the heart and vessels	875
" " " " the respiratory organs	875
Proof that water does enter the lungs in drowning	876
Experimental injection of water into the lungs of animals	876
Absorption of water by the pulmonary membrane	877
Physiology and pathology of apnœa	877
Table of causes of apnœa	878
Apnœa from mechanical obstruction, as suffocation, strangulation, &c. (simple apnœa)	878
Experiments on this form of apnœa	879
Apnœa from submersion	880
Experiments on animals	881
The reason that complete submersion is more rapidly fatal than simple apnœa	881
Water detected in the blood	881
Application of these facts to cases of exposure to foul gas	883
Effects of syncope in favouring recovery	883
After what time of submersion is recovery possible?	883
Effect of temperature on rapidity of death	884

	PAGE
Apnoea from absence of oxygen in the respired gas	884
Phenomena of death from immersion in nitrogen	884
Apnoea, incorrectly so called, from inhalation of poisonous gases .	885
Experiments to show the cause of death by chloroform	885
Theory of the cause of death in apnoea	886
Theories hitherto proposed	886
Arguments to show that the real cause is interruption of inter- stitial nutrition from want of oxygen	887
Secondary apnoea, description of	889
Referred to the effects of bad tissue laid down during the period of interrupted interstitial nutrition	890
Illustration from experiments on starvation	890
Treatment of apnoea	891
Artificial respiration—By manual pressure	892
" " Marshall Hall's (or the ready) method	893
" " Silvester's (or the physiological) method	893
" " Mouth-to-mouth inflation	894
Recommendations of Committee of Med.-Chir. Society	895
Importance of detecting the cause in simple apnoea	895
Treatment of apnoea from substances swallowed	896
" " " suffocation	896
Artificial respiration in infants	897
The lungs can be inflated through a catheter	897
Treatment of apnoea from scalding of the fauces	897
" " " strangulation	897
Instance of fracture of the hyoid bone	898
Bleeding in apnoea	898
Treatment of apnoea from drowning	899
Prognosis in drowning	899
Treatment of apnoea from irrespirable gases	900
Rules of treatment in apnoea	900

ON PARASITES, AND THE DISEASES WHICH THEY PRODUCE.

By G. BUSK, Esq.

SURGEON TO THE DREADNOUGHT HOSPITAL SHIP.

General description of parasites	902
Animal parasites—I. Parasitic infusoria	903
Trichomonas	903
II. Parasitic annuloida	903
Platyelmia	904
Taniada	904
Method of propagation—their cyst- worms	905

	PAGE
Cysticercus cellulosæ . . .	905
Its geographical distribution . . .	906
Comparative frequency in various organs . . .	906
Symptoms in muscles . . .	907
" eye . . .	907
Echinococcus—its various forms and manner of growth . . .	907
Relation of to tape-worm in dogs . . .	909
Rate of growth . . .	909
Treatment . . .	910
Trematoda . . .	910
Fasciola hepatica . . .	911
Distoma ophthalmobium . . .	911
Bilharzia hæmatobia . . .	912
Nematelmia . . .	912
Trichina spiralis . . .	913
Its source from pork . . .	913
Symptoms . . .	914
Filaria medinensis, or guinea-worm . . .	914
Its geographical distribution . . .	914
Probable mode of development . . .	914
Description of . . .	915
Symptoms and effects . . .	916
Method of extraction . . .	917
Filaria lentis . . .	917
Oxyuris vermicularis . . .	917
Doubtful and false nematoid entozoa	
—Strongylus gigas . . .	917
Spiroptera hominis . . .	918
Dactylius aculeatus . . .	918
III. Arachnida . . .	918
IV. Insecta—pulex penetrans, or chigoe . . .	918
Vegetable parasites—Fungus-disease of India . . .	919
Symptoms of its two varieties . . .	919
Appearances on dissection . . .	920
The fungus—Chionyphe Carteri . . .	920

VENOMOUS INSECTS AND REPTILES.

By G. BUSK, Esq.

SURGEON TO THE DREADNOUGHT HOSPITAL SHIP.

A. Invertebrata—Poisoned wounds by insecta and arachnida . . .	921
(a) Scorpions . . .	921
(b) Centipedes . . .	921

	PAGE
(c) Spiders	922
Tarantula	922
Aranea 13-guttata	922
(d) Venomous insects	922
The tsetse	923
Stings of bees, wasps, and hornets	923
B. Vertebrata—Wounds inflicted by venomous snakes	924
Characteristics and classification of venomous reptiles	924
Characters of the viperina	924
" " colubrina	925
Nature of the venom and its effects	926

SURGICAL DIAGNOSIS AND REGIONAL SURGERY.

By T. HOLMES, ESQ.

SURGEON TO THE HOSPITAL FOR SICK CHILDREN, AND ASSISTANT-SURGEON TO
ST. GEORGE'S HOSPITAL.

SURGICAL DIAGNOSIS. The three elements on which diagnosis is founded	927
I. The History. History of the patient—Age	929
Sex	930
Occupation	930
Social condition	931
Habits	931
Previous diseases	931
Hereditary tendencies	931
History of the case—The alleged cause	932
Duration of the disease	933
Course of the disease	933
Effects of treatment	934
II. Symptoms of the disease	934
Those referred to the nervous system	935
Pain	936
" " organs of sense	936
" " " respiration	936
" " " circulation	937
" " " digestive system	937
" " " urinary organs	938
" " " genital organs	938
" " " locomotive system	938
Miscellaneous	938
III. Physical examination of the parts :	
By the sense of sight. Use of the microscope	939
" ophthalmoscope and specula	940

	PAGE
Alterations in form	940
" " colour	940
" " volume	940
" " transparency	940
By the touch. Emphysema	941
Crepitus	941
Fluctuation	942
Ambiguities of fluctuation	942
Alterations in relation	943
" " mobility	943
" " pulsation	943
By the hearing	943
By the smell	943
Chemical examination	943
Table for registration of cases	944
REGIONAL SURGERY. Of the head—The various laminæ found in this region	947
1. Affections of the hairy scalp—Sebaceous cysts	947
Vascular tumours	948
2. Of the subaponeurotic cellular tissue—Blood-tumour	948
3. Beneath the pericranium—Cephalæmatoma	949
4. Of the skull—Table of these diseases	950
5. Of the cranial contents—Encephalocele and meningocele	952
Tumours of dura mater and diploë	953
Hydrocephalus	955
Of the face—Tumours—Sebaceous cysts	957
Cysts of other kinds	957
Parotid glandular tumour or hypertrophy	957
Method of removing these tumours	957
Recurrence of such tumours	958
Enchondroma and hypertrophy of bone	959
Narrowing of opening of mouth	959
Inflammatory affections—Parotitis and mumps	960
Abscess of parotid gland	960
Salivary calculi	960
Epithelial, rodent, and lupous ulceration	960
Operative treatment of such cases	961
Of the neck—Arrangement of the cervical fascia	961
Superficial tumours	962
Hydrocele and compound cystic tumour	962
Treatment	963
Deep sebaceous cysts	964
Enlarged glands—Strumous	964
Syphilitic	964
Chronic inflammatory enlargement	964
Tumour of uncertain nature	964
Operations in these cases	965
Epithelial cancer	965
Abscess and its diagnosis	965
Induration of the sterno-mastoid muscle	965
Enlarged bursæ	966
Indications for operating on deep tumours of the neck	966

	PAGE
Rules for such operations	967
Notices of such operations	968
Of the axilla—Abscess	969
Tumours	969
Operations on enlarged glands	970
Rules for operating on tumours in the axilla	971
Of the thorax—Diffuse inflammation of its walls	972
Abscess	972
Disease of the bones	972
Resection of portions of ribs	973
the sternum	973
Of the abdomen—Tumours—Superficial	973
Deep—movable—Fibrous tumour of	
iliac fossa	974
Floating	975
Immovable—Of bones	975
Malignant	975
Of viscera—Watery cysts	
of liver	976
Hydatids of liver	976
Other visceral tumours	977
Of the groin—Enlarged glands	977
Cysts	978
Phagedæna in groin	978
Of the popliteal space—Normal anatomy of the bursæ	979
Dilated synovial follicles	979
Bursal and other cysts	980
Diagnosis	980
Blood-cysts	980
Treatment of popliteal cysts	981
Diagnosis of abscess	981
Rupture of popliteal vessels	982
Necrosis of popliteal space of femur	982
Of the limbs	982

ON HOSPITALS.

By SIR J. RANALD MARTIN,

EXAMINING MEDICAL OFFICER TO THE SECRETARY OF STATE FOR INDIA
IN COUNCIL.

Origin and institution of hospitals	983
Site and construction	987
Principles of construction	988
Advantages of country site	989
Shape and arrangement of wards and water-closets	990

	PAGE
Subordinate arrangements, kitchen, laundry, sculleries, sinks, &c.	991
Requisites for the site of a hospital	993
Ventilation of hospitals—the pavilion plan	994
Plan of the Lariboisière Hospital	995
Rules for hospital ventilation	996
Lighting of hospitals	998
Mackinnell's method of ventilation	1000
Description and plan of the Herbert Hospital, Woolwich	1002
Hygiene of hospitals	1004
Administration	1005
Governing body	1006
Number of beds to each officer	1007
Hospital systems	1007
Size and proportions of wards	1008
Cubic space per bed	1008
Subdivision of sick	1009
Admission into hospital	1010
Selection of sick	1010
Dieting of the sick	1011
Dr. E. Smith's recommendations	1014
Nursing and nurses in hospitals	1016
In military hospitals	1018
In civil hospitals	1020
Respective duties and relative position of nurses and orderlies	1022
Statistics of hospitals	1024
Mortality of hospitals	1027
Opinions on the subject of the mortality of hospitals expressed in the Sixth Report of the Medical Officer of the Privy Council	1030
The finance of hospitals	1031
Convalescent hospitals	1034
Description of the hospital at Vincennes	1036

SURGICAL INSTRUMENTS AND APPARATUS.

By HOLMES COOTE, ESQ.

SURGEON TO ST. BARTHOLOMEW'S HOSPITAL; AND

J. C. WORDSWORTH, ESQ.

SURGEON TO THE ROYAL LONDON OPHTHALMIC HOSPITAL.

The pocket-case, and the instruments required in it	1037
Acupressure needles for restraining hæmorrhage	1038
The female catheter and its use	1039
The écraseur	1040
Galvano-caustic cutting noose	1041
Instrument for removing foreign bodies from the ear	1041
Tonsil-guillotine	1042

CONTENTS OF VOL. IV.

xli

	PAGE
Amputation case	1042
Tourniquets	1042
Butcher's saw	1042
Fergusson's and Weiss's saws	1043
Trephines and rosehead	1043
Trephining the skull	1044
Necrosis instruments	1045
The lion-forceps	1045
Laryngeal canula-forceps	1045
Tracheotomy trocars	1046
Pharynx-forceps, probang, and stomach-pump	1046
Thompson's and Wells's trocars	1047
Rectum- and urethra-instruments	1047
Lithotrites	1048
Eye-instruments	1048
Fracture-apparatus	1050
Luke's fracture-bed	1050
Arnott's bed	1051
Instruments for spinal curvature	1051
Instruments for extension and pressure	1052
INDEX	1053

ERRATA.

VOL. I.

p. 73, 1st line of foot-note, *for* overleaf *read* in the succeeding fourth paragraph
 77, l. 13, ,, forms ,, focus
 160, l. 11 from bottom, ,, M. ,, Mr.
 231, last line, ,, 1857 ,, 1827
 242, l. 19, ,, 1858 ,, 1848
 493, headline, ~~dele~~ Myeloid.
 806, note *, ,, Bushnau ,, Bushnan

VOL. II.

p. xxii. line 6 from bottom, *for* 858 *read* 885
 251, l. 9, ,, article INJURIES ,, the essay on DISEASES
 269, note, ,, p. 390, 1830 ,, 1830, p. 390
 484, line 5 from bottom, ~~dele~~ b.
 500, l. 8, ,, and testicles
 712, note, *for* DISEASES OF THE TEETH *read* APPENDIX, SURGICAL DISEASES OF
 CHILDHOOD
 887, l. 8, *for* ; if the paralysis is complete, *read* , if the paralysis is complete ;

VOL. III.

p. xxii. l. 25, *for* 597 *read* 596
 ,, l. 26, ,, 599 ,, 597

VOL. IV.

p. 115, l. 25, *for* other *read* others
 125, l. 11, ,, root ,, roof



SURGICAL DISEASES CONNECTED WITH THE TEETH, AND THEIR TREATMENT.

THE limited space allotted to the author of this essay for the consideration of the Diseases of the Teeth, and their treatment, compels him to forego, to a great extent, dwelling on those which most commonly fall under the special care of the surgeon-dentist, and to confine himself, almost entirely, to those surgical *complications* which are associated with, and dependent upon, abnormal conditions of the teeth.

The subject of “teething,” and the ailments of childhood contingent on that process; the irregularities and deformities depending on the shedding of the temporary teeth, and the advent of their permanent successors, would alone occupy, if treated with justice to their importance, more space than can be afforded to the entire essay: and the treatment, moreover, of the irregularities of the permanent teeth requires an amount of pictorial illustration, to render the subject intelligible, which is inconsistent with the resources and character of this work.

Another matter which is of the last importance in the treatment of the teeth, *stopping* or *plugging* carious cavities and other defects of surface, is a subject of such extent, and involves so much preliminary discussion upon purely physical questions, that it is impossible to enter here upon its consideration. Indeed, the treatment of those most usual and ordinary abnormalities of the teeth, irregularities in the position of the permanent set in young people, and carious cavities, entail to so great an extent a particular mechanical knowledge in combination with surgery, both its science and art, that it has naturally, and indeed inevitably, assumed that *special* character of practice and of surgical treatment which we see at present accorded to it; and for these reasons, combined with the want of space which I have before mentioned, I am constrained to refer the reader, for the consideration of these subjects, to those works which have been specially devoted to their elucidation.

In the following pages, therefore, I shall describe, as far as my limits allow, those surgical diseases and abnormalities, with their

treatment, which are more or less connected with the teeth, under the following heads :

- I. Alveolar abscess.
- II. Painful and difficult eruption of the wisdom-teeth.
- III. Tumours of the gum and tooth-pulp.
 - (a) Epulis.
 - (b) Congenital hypertrophy of the gum and alveolar borders of the maxillæ.
 - (c) Polypus of the gum.
 - (d) Vascular tumours.
 - (e) Polypus of the tooth-pulp.
 - (f) Sensitive growth of pulp after fracture.
- IV. "Abscess" of the antrum.
- V. Dentigerous cysts.
- VI. Alveolar and maxillary necrosis from
 - (a) Phosphorus fumes.
 - (b) Eruptive fevers.
- VII. Hæmorrhage after extraction.
- VIII. The application of obturators, &c. in fissures of the hard palate or fistulæ of the antrum.

I. *Alveolar abscess.* One of the commonest consequences of dental caries, and occurring occasionally independent of any apparent disease in the teeth, is this troublesome, and too often ill-understood, malady. The results of this condition, when appearing on the external surface of the face (cheek, jaw, or chin), are occasionally so remote from any obvious connexion with the teeth, and the patient's symptoms so fail to indicate its association with them, that the true nature and cause of the suppuration is lost sight of, and an easily-remedied disease is indefinitely protracted.

Alveolar abscess may be defined as a suppuration around the fang or fangs of a tooth, usually carious, accompanied by absorption and expansion of the bony walls of the alveolus or alveoli, and the enlargement of the little pus-sac, the matter gradually finding its way to the surface either along a canal by the side of the fang of the tooth opening at the edge of the gum, or through the gum itself at a point corresponding to the end of the root (or roots) of the tooth implicated. When, however, the fangs are unusually long, or the reflection of the mucous membrane, from the gum to the cheek or lip, is very superficial, this same discharge may burrow still more outwardly, and find its exit upon the surface of the face.

The pathology of alveolar abscess, especially in its commonest

form of "gum-boil," has not been generally understood. The first change which occurs in the development of this condition consists in the deposit around the extremity of the fang or fangs of the tooth of organisable lymph, which is soon differentiated into obscure fibrous tissue. Coincident with this development, the bone around the end of the tooth-fang becomes absorbed, and a little hollow in the jaw is produced, varying in size from a lentil-seed to that of a horse-bean. Thus far the change is simply one of plastic inflammation: it occurs, as far as my observations go, with every carious tooth, and in those with more than one fang is most conspicuous at the extremity of that root which corresponds with the side or part of the crown where the caries occurs.

These changes are often accompanied by absorption, to a varying amount, of the extremity of the fang; and this appears to be part of the same action as produces the excavation in the maxilla itself, which is occupied by the plastic exudation. There is generally, too, a thickening of the alveolar periosteum, which raises, and often loosens, the affected tooth.

It is the lymph surrounding the extremity of the fang, and occupying the little cavity produced by the bone-absorption, that is the seat of suppuration in alveolar abscess. Whatever may be the first actual point of suppuration, when sufficient pus is formed for recognition, it is found in immediate contact with the fang of the tooth—the bare naked *crusta petrosa*, and surrounded by the half-organised lymph, as by a sac. The form of this sac varies considerably; it is usually spherical or pyriform where the fang is single, or if the tooth have more than one fang, and the fangs are distinct; but where the fangs are close together, or the root is simply cleft at its extremity, as is often the case with the superior premolars, the sac is frequently double and bilocular. The sac is sometimes of large size, and is frequently very long; sometimes it is fringed with fimbriated processes of lymph, which occupy an elongated excavation in the maxilla. When suppuration is established, the sac enlarges according to the amount of matter formed, and the rapidity with which it is developed; and this is accompanied with a dilatation and absorption of the bony walls of the abscess, especially towards the region at which the matter is "pointing." These latter changes are often very extensive and very rapid; so that the whole of the osseous tissue of one wall of the alveolus may be expanded and thinned into a mere papery film, and then completely absorbed in comparatively few hours, the periosteum, with the organised lymph that has been the seat of the sup-

uration, alone remaining as the membranous sac of the abscess. The development of an alveolar abscess is generally accompanied by a deep throbbing pain at the part affected, and often by great general swelling of the face, sympathetic of the more internal mischief. The distortion of the countenance from this cause is sometimes prodigious, especially when the upper incisors or canines are the cause of the abscess, and the attack is acute. In such a case the nose will be pushed on one side, the eyelids become œdematous, closed, and ecchymosed. In other instances, where the character of the affection is less intense, a mere indurated, indolent, and hard swelling on the side of the jaw is all that is produced; the maxilla being distended at the extremity of the tooth's fang, and but little bone absorbed.

Alveolar abscess is usually confined to the tooth or one fang (when the tooth has more than one) which has been the cause of the affection, and around which the plastic exudation has formed. Occasionally, in two- or three-fanged teeth, the intervening bone between the extremities of the individual fangs becomes absorbed, and one abscess may be common to all. Again, there is another form of alveolar abscess which occasionally affects the upper jaw and front teeth in persons of cachectic and debilitated constitution, in which suppuration appears to affect generally the tissues surrounding the roots of several teeth in a diffuse manner: the teeth become excessively loose, and the front of the jaw around them becomes boggy and suppurates abundantly, the discharge usually flowing around the necks of the teeth. The teeth are often, indeed generally, sound, and are probably only secondarily affected. I incline to the opinion that this form of alveolar abscess is dependent on constitutional taint—scrofulous or syphilitic.

The “pointing” of the matter in alveolar abscess is a question of some moment, both as regards diagnosis and treatment; and the circumstance that the discharge of pus may occur upon the surface of the face, entailing with it very great disfigurement, adds serious importance to this consideration.

An alveolar abscess affecting the one-fanged teeth may find vent for its secretion by a gutter or channel along the course of the fang, the matter being discharged at the neck of the tooth. This seldom occurs to the many-fanged teeth, and is most commonly seen with the inferior incisors,—the pus flowing from the front edge of the gum at a point corresponding with the particular tooth affected. The commonest position at which the thinning and bursting of the abscess takes place is on the outer surface of the jaw, at a

point corresponding, as nearly horizontally as may be, with the extremity of the fang of the affected tooth, and *piercing the gum within the mouth*. In such common cases the diagnosis is perfectly simple and obvious, and the abscess is easily associated with the individual tooth that produces it. There are, however, instances in which the pointing of the abscess, after having taken a lengthened and burrowing course, is remote from its cause. The most striking peculiarity of this kind is where a circumscribed collection of matter appears far back in the palate, occasionally at the very posterior extremity of the hard palate, dependent on affection of one of the six front upper teeth. Such a condition may readily fail to indicate its true explanation, and may suggest the presence of necrosed palatal bone; it is important, therefore, in the practice of general surgery, to recollect that this obscurity may present itself. As far as my own experience has gone, caries of the *superior lateral incisor* tooth has generally been the cause of this remote-pointing abscess. Why it should be so, I cannot say; but the pathological anatomy of the affection is the same as in ordinary cases, only the canal of the abscess is lengthened out in the narrow cancellated bone between the two compact plates of the palatal process of the superior maxilla. A critical scrutiny of the front teeth (incisors and canine) will scarcely fail to show which is the offender.

The forms of alveolar abscess which we have just considered are trivial in their importance in comparison with those which, in their advancing course, involve the integument of the face. It is a curious circumstance that alveolar abscesses, when pointing externally upon the face, have been so frequently misunderstood by Surgeons, having been mistaken either for idiopathic abscess in the substance of the cheek, or suppuration associated with necrosis of more or less of the maxillary bones. To the superficial observer (and, indeed, in its consequences) there is a vast difference between a common gum-boil and an abscess which pierces and discharges its contents upon the surface of the cheek; but the cases are identically the same, barring the point where the pus is evacuated.

The circumstances which determine the pointing of an abscess upon the surface of the face appear to be either an unusual length of the fang of the tooth, or a superficial reflection of the mucous membrane from the jaw to the cheek; so that, in either case, the abscess which is forming around the extremity of the fang does not correspond horizontally with the gum within the mouth, and thus in its course outwards it passes either above or below (as it may occur in the upper or lower jaw) the line where the mucous mem-

brane folds from one surface to another. In some cases, however, it takes an outward course, irrespective of these conditions.

I am not aware that alveolar abscess, associated with the superior incisors or canines, ever points upon the surface of the face; the bicuspid, first and second molar, and all the teeth of the lower jaw, may produce this form of the disease. In the upper jaw the abscess appears upon the cheek at a point corresponding with the extremity of the tooth's fang, under the edge of the malar bone; in the lower jaw it forms along the edge of the jaw below the buccinator muscle when the molars or bicuspid are its cause; but when associated with the inferior incisors (canines also?), it points generally beneath the chin.

When an alveolar abscess is about to point externally, the integument becomes firmly glued down to the bone around the spot where the matter ultimately appears; the area within this space is red, distended, and glistening; the skin becomes thin and papery, and the epidermis scales off. If the surface be kept dry, the breaking of the abscess is often tardy and delayed; but it ultimately bursts through a jagged opening, which soon changes into a small fistulous orifice, surrounded by a pouting circular lip of granulations, that sinks into a depression, surrounded by the adhesions which limit the pus-discharging canal. The appearances now are very characteristic, and when once recognised cannot be afterwards mistaken. Sometimes the lip of granulations becomes elongated into a papilla, and is covered with cuticle. I have seen one more than half an inch in length. The apex of this papilla has an orifice, which is the outlet of the fistulous canal communicating with the abscess; it frequently closes for a time, but bursts again, as the matter accumulates. When once this papilla forms, it returns again and again, after excision by the knife, till the cause of the whole malady (the carious tooth) is removed. Another curious modification of the external orifice of the alveolar abscess is often seen when it pierces the under surface of the chin; in such cases a large *pad* of granulations frequently forms, as large as the area of one's thumb-nail, from the centre of which the discharge flows.

In children, with the milk-teeth, alveolar abscess very seldom, if ever, opens on the surface of the face. I have never seen such an occurrence. On account of the extreme thinness of the alveoli in them, the end of the affected fang frequently appears through the orifice of the discharge, and often projects so far as to wound and ulcerate the mucous membrane of the cheek or lip.

It sometimes happens, that after the first evacuation of the pus of an alveolar abscess the secretion becomes serous. I have known some instances in which the sac of the abscess has remained as a serous cyst even after the extraction of the tooth upon which it originally depended, the secretion recurring again and again after the cyst had been lanced. In one instance, where it had happened in a child in connexion with an upper incisor tooth, I found it necessary to remove a portion of the wall of the cyst, when it granulated from the interior, and was obliterated.

The *diagnosis* of alveolar abscess is really very simple, though, as I have said, it is often mistaken for diseased bone in those examples where the orifice occurs on the surface of the face. The tooth is the equivalent in these cases of a sequestrum; and it is, as far as the pulp-vitality goes, a dead organ. The fistulous canal leads to the dead tooth, as a sinus to the dead bone; thus far the two conditions are alike, and their appearances are alike; but there are obvious differences. In alveolar abscess there is less general swelling, except at first in acute cases, and there is an absence of the diffuse indurated lymph-infiltration of the cellular tissue which is present in bone-necrosis; the canal leading to the abscess is single, usually short and direct, and not burrowing and complicated as in bone-disease; moreover, there is an absence of fœtor in the discharge. The locality in a doubtful case, being the neighbourhood of the jaw, is in favour of the idea of a tooth being the cause; and an appeal to the state of the teeth seldom fails to settle the question definitively. Sometimes, however, a difficulty may arise from the fact that the cause of the abscess is a mere stump, overlapped by prominent gum; or, what occasions still more obscurity, the abscess may consist of a large excavated cavity in the substance of the jaw, into which the stump has fallen and become loose and free. A probe and the elevator will in either case complete the investigation.

While alveolar abscess, when connected with the integument of the face, is very apt to be mistaken by Surgeons for diseased bone, the reverse has happened where a dentist has attributed to carious teeth morbid conditions which have been coincident with them, though not produced by them. I have known this occur in an instance where the patient was suffering from scrofulous caries of the malar bone near its suture with the superior maxilla,—a mistake which led to the extraction of two slightly damaged teeth in no way connected with the disease. Again, I have seen one of the sub-maxillary lymphatic glands, rather adherent to the bone and in an early state of suppuration, mistaken for an outward-pointing

alveolar abscess. Such errors as these, leading at most to the extraction of carious, though innocent, teeth, are trivial in comparison with those more frequent mistakes in which alveolar abscess is confounded with bone-disease, and an easily cured malady is allowed to run its course unrestrained, and permanently disfigure the face.

The *cause* of alveolar abscess is either caries of a tooth or death of the organ; the latter usually the result of mechanical violence, which has separated the pulp from its continuity with the subjacent nervous and vascular structures. It is uncommon to see the affection arise in association with sound and apparently uninjured teeth.

The *treatment* of alveolar abscess depends upon the stage at which the case is seen. In the earliest period, when suppuration is rather impending than established, the malady may be cut short by the extraction of the affected tooth, or by the removal of the stopping in a stopped tooth. Often it is undesirable to extract a particular tooth that may be threatening or causing the abscess; and in that case recourse should be had to leeching the gum freely, the administration of brisk purgatives, and abundant hot fomentation of the face at the swelling part. This mode of treatment, when it does not arrest the malady, much mitigates the attendant sufferings. When matter has formed, and the wall of the abscess has sufficiently thinned, the pus should be evacuated by a puncture made through the gum with a narrow thin scalpel. This is followed by immediate and complete relief, and the general swelling associated with the advent of the attack rapidly subsides; but the disease, in the very great majority of cases, remains in the form of a continuously pus-discharging fistula. It is very rare indeed for the pus-secretion to cease: it may be so diminished that the external orifice may close for a time, but it is pretty sure to burst out again and again; though I am confident (contrary to the general published opinion) that in a few exceptional instances the disease ceases altogether, the offending tooth still remaining in the mouth.

When an alveolar abscess shows symptoms indicative of external pointing, immediate and active treatment is necessary. The offending tooth should be taken out; and in case it break in extracting, every vestige should be sought and removed. The smallest amount of remaining fang will keep up the malady and insure its progress. If matter have formed, and there has been decided thinning of the integument, showing its near approach to the surface, not only should the tooth be extracted, but a vertical incision should be made between the cheek and the jaw, so as to cut across the pus-contain-

ing canal; else the matter is apt to *pocket*, and cause progressive absorption to the surface; and though the tooth be removed, the abscess may thus still open externally. This vertical incision between the cheek and the jaw is also useful after the removal of a tooth, even when the external opening has occurred; it cuts across the bands of lymph which glue the integument down to the bone: in this case a piece of oiled lint should be introduced and kept in the wound, to prevent the adhesion and reunion of the cut surfaces. In all cases of alveolar abscess, extraction of the diseased or dead tooth is *the* cure; and I know but of two circumstances which peremptorily interdict this mode of treatment. First, where a strongly pronounced hæmorrhagic diathesis forbids the extraction of teeth altogether; and secondly, in those cases where the abscess is associated with the upper incisor teeth of young people in whom the jaws have not yet assumed their adult form, and where the permanent dentition is, as yet, incomplete. In this latter case it is of much importance to retain the teeth, even if reduced by decay to mere fangs, till the adult form of the jaws is established, even at great cost of suffering and discomfort. The earlier removal of the teeth would be followed by such contraction of the maxillary arch as would be incompatible with a proper replacement by artificial teeth of the natural ones missing.

II. *Painful and difficult eruption of wisdom-teeth.* The advent of the wisdom-teeth is very often accompanied by painful and distressing symptoms, that may be protracted through many months, or even years, unless relieved by surgical interference. These circumstances arise from the position occupied by these teeth, so close to the joint of the lower jaw, where the mucous membrane is reflected from the gum to the cheek and fauces, combined with the very common condition—that the jaw is not sufficiently elongated backwards to allow the *dentes sapientiæ* to range in the horizontal series with the other teeth. This mechanical difficulty not only prevents the proper evolution of the wisdom-teeth, holding them back in their bony bed, but it often perverts their direction of growth and dislocates them. Annoying and very painful as are often the symptoms attendant on difficult cutting and misplacement of the upper wisdom-teeth, they are trivial in comparison with those which occur in similar conditions of the lower.

The ordinary misplacement of the upper wise teeth is either backwards or outwards, or in both directions combined. When the tooth points backwards, every time the mouth is closed its

crown comes in contact with the mucous membrane, passing up on the base of the coronoid process; when the direction is outwards, which is more common, the tooth projects into the cheek, and when the jaws are brought together, a portion of the mucous membrane in this region is nipped and pinched. This is a very painful affair: the surface becomes ulcerated and extremely tender; there is a partial cicatrisation, and the structure becomes stiff and hard as well as painful. Beyond this, however, the symptoms never (as I believe) extend, and the removal of the offending tooth is always followed by complete and immediate relief.

The difficulty which most commonly occurs with the inferior dens sapientiæ is attributable to insufficient room in the jaw: the tooth grows normally in direction and in position as regards its neighbour in front, but, from an imperfect lengthening of the horizontal ramus of the jaw, the birth of the crown is only partial and incomplete: the tooth is upright, but only its front cusps emerge through the gum, while the hinder cusps are still covered in with gum, or even the upper wall of the bony locus in which it was formed. This produces a terrible pinching of the mucous membrane over the tooth every time the jaws are brought together. Before, however, the enamel eminences of the tooth's crown make their appearance, the soft structures behind the second molar become much inflamed, and often suppurate, the pus-secretion appearing to be within the enamel sac of the tooth, between the tooth-crown and the membrane covering it. The inflammation, to which this impaction and pressure give rise, extends to surrounding tissues: the cheek and the fauces suffer; the movements of the jaw become stiff and painful; and deglutition is difficult, and attended with suffering like "sore-throat."

The next frequent condition of perverted wisdom-tooth development in the lower jaw is where the organ points more or less horizontally forwards; and this is attended with the most severe consequences. This direction is sometimes combined with an inward leaning; and very rarely the crown of the tooth points outwards. This latter dislocation is very unusual; but the severest case of suffering from misplacement of the lower wisdom-tooth which I have ever seen was of this variety.

There is one peculiar symptom frequently associated with the painful cutting of a lower wisdom-tooth, which adds to the difficulty of investigating the condition of the parts, and still more interferes with the treatment: this symptom is *spasmodic contraction of the masseter muscle*, of a continuous and persistent character, the result

of contiguous irritation; not a spasm which varies in intensity, but a true *tonic* spasm, the muscles being permanently *set*, so as to keep the jaws nearly closed, and susceptible only of very slight separation. The jaw can usually be opened to a small extent, and then is definitely fixed; it feels as if there were a mechanical obstacle to further movement; but it is not so; for when the cause of irritation is removed, the spasm rapidly ceases, and then the mouth can be fully opened. The pain that accompanies and precedes the cutting of a wisdom-tooth varies very much in different individuals; but it is frequently of a dull aching character, like rheumatism, for which it is occasionally mistaken; it is diffuse and erratic, extending up the side of the head, and down to the shoulder. There is not unfrequently a good deal of swelling of the soft parts in the neighbourhood of the tooth, and this sometimes extends to the cheek and to the eyelids even, and below the angle of the jaw: the lymphatic glands beneath the jaw also occasionally become enlarged and tender.

The most distressing result, however, that occurs in these cases is the suppuration which attends the difficult eruption of the tooth. In slight cases, even where there is no misplacement or want of room, but simply a restrained progress, from an unusually dense or cartilaginous overlying gum, pus will be occasionally formed; being secreted (as it has seemed to me) within the capsule of the tooth, by that which was the "enamel pulp." In severer cases, the pus burrows among the areolar tissue, around the periosteum of the jaw; the neighbouring soft structures become infiltrated with lymph, and the integument is glued irregularly to the bone; pus points at different spots, often remote from its original source; and the whole cheek may be undermined with a series of sinuses. I have seen the side of the face, from the tragus of the ear and the angle of the jaw behind, to the angle of the mouth and mental foramen in front, a web of pus-discharging fistulæ, and which, after their cure (by the mere removal of an impacted wisdom-tooth), left the integument thin, and bound down to the bone, with the glossy, tense, cicatrix-like aspect of a recently-healed burn—a great and permanent disfigurement. While such cases are in activity, they have very much the appearance of necrosed bone. And, indeed, they do occasionally lead to necrosis of more or less of the jaw; but the severest suffering and most suspicious symptoms may occur without such a complication. What is the precise anatomical condition of these burrowing suppurations I am not prepared to say positively. They are not apparently connected with the fang

of the wisdom-tooth, like an alveolar abscess. I believe they commence in the enamel sac, before any portion of the crown pierces the gum; and their subsequent course of burrowing is from the matter *pocketing* in a downward and onward progress. As long as any part of the crown of the tooth is covered by gum, pus will be secreted by the under surface of the overlying portion. I have seen an impacted wisdom-tooth give rise to that form of serous cyst known as a "dentigerous cyst." In those instances where the crown of the wisdom-tooth projects forwards, the second molar very often suffers. The posterior fang is apt to be eroded by absorption, and the whole tooth may become necrosed; the first of these conditions is very common: I have met with several instances of it; in four specimens of lower second molars now before me, which were removed on account of forward pressure of wisdom-teeth, the posterior fangs are excavated by absorption in all; in two the pulp-cavity is closely approached; in two it is opened, and in one of the latter there was total necrosis of the whole tooth; the periosteum was completely stripped from both fangs, which were unattached in their sockets, and bathed in pus. These affections of the second molar should be taken into consideration in balancing the merits of the plans of treatment which may be contemplated in any particular case, and will, I think, favour that course of proceeding which I believe ought in many instances to be followed, but which is not now usually adopted.

Treatment. The wisdom-tooth of the upper jaw, when misplaced, suggests but one mode of treatment: it by far the most often projects outwards; it is then useless for mastication; and if it pinches the cheek painfully on closing the mouth, it may be removed unhesitatingly and without compunction. The same may be said when it grows backwards, and bruises the mucous membrane over the base of the coronoid process: the tooth is useless, and worse than useless, and should be extracted; it is very readily done, and, as far as I know, the annoyances attendant on the misplacement of the upper wisdom-tooth are never attended with that locked-jaw complication which so frequently attends the difficulties of the lower third-molar eruption. In one rare instance, in which the upper wisdom-tooth grew forwards, it was found necessary to extract the second molar, on account of damage which it had occasioned by producing absorption of the neck of the anterior tooth.

In the treatment of these cases in the lower jaw, much will depend on the degree of impaction of the tooth: if it is simply covered over by a dense and cartilaginous gum, free lancing is all that may

be required; but it will often have to be repeated. In young precocious people, who arrive very early at puberty, the wisdom-teeth often make their appearance before the jaw is ready for their reception, and are embedded in the base of the coronoid process, though in a proper upright position. The age of the patient in such a condition is an important question: if young, lancing the gum freely, and waiting for further elongation of the jaw, and more horizontal accommodation, may be fairly and reasonably adopted; but the same state of things in an older patient is not so likely to find this relief; and if the suffering of the patient is great, extraction of the impacted tooth will become necessary. Where the tooth emerges tardily, and where the anterior cusps have come through the gum while the posterior have remained covered, I have found great advantage not only in lancing, but in cutting away the gum which overlies the back of the tooth, so as to lay bare the whole of the masticating surface of the crown. Merely lancing the gum affords much less relief, and the cut surfaces are apt to unite, and then present a harder and more resisting impediment. If the impaction is severe, and there is no chance, from the age of the patient, of sufficient accommodation, it will be necessary to extract a tooth, so as to relieve the crushing tension; and the question now arises as to which of the two, the second or third molar, should be extracted. *Cæteris paribus*, it is always better to sacrifice the third than the second molar: the wisdom-tooth is less useful for mastication, and is more liable to decay; it is altogether less robust: but the circumstances of the two teeth may not be equal or parallel—the second molar may be carious, or it may be loose or necrosed by the pressure of the tooth behind it: in either case I prefer extracting it to the wisdom-tooth. Again, the wisdom-tooth may be so situated that its extraction may be a physical impossibility, or nearly so, as is frequently the case where it grows horizontally forwards, deep down in the jaw. Another reason, the rigidity of the masseter spasm, may render it impossible to reach the tooth. In either case I should extract the second molar, though perfectly sound, without hesitation. The distressing symptoms which are peculiar to the difficult eruption of the *lower* wisdom-tooth—the heavy pain, the sense of *tension* and *pressure*—are clearly dependent on the antagonism of the third and second molars; the former pushing forward into place, and the latter resisting its progress. The removal of the second molar puts an end to this antagonism as completely as that of the wisdom-tooth; and, in result, the one operation gives as entire and immediate relief as the other. When

the second molar is extracted, the wisdom-tooth comes forward wonderfully; and an oblique or nearly horizontal tooth will advance in position, and alter in attitude, so as to become nearly, or quite, vertical, and a fair opponent to the upper second molar. I have thought, too, that in this improved position, when it can be used habitually in mastication, the dens sapientiæ is less liable to caries.

The closure of the jaws is often so complete that, until this condition has been combated, it is impossible to get at either of the molar teeth. By pressing apart the jaws with some sort of wedge, this may be accomplished gradually, and in two or three days sufficiently to allow the removal of the tooth selected for extraction. Steel instruments have been devised on the principle of an ear speculum, composed of two shafts or blades, which separate slowly, but forcibly, by the action of a screw. I prefer a wedge of hard wood, such as beech- or box-wood, which is pushed further and further into the mouth, as the contracted masseter yields before it. It seems to obliterate the spasmodic contraction for so much at each further introduction, and in a few days such an instrument will open the mouth sufficiently for tooth-extraction. Another arrangement, however, invented by Mr. Maunder of the London Hospital, seems to possess advantages over those previously in use. It consists of a cone of box-wood or ivory, upon which is cut a spiral screw-worm, gradually increasing in diameter and in thickness of the worm: it resembles the shell of a univalve mollusc, such as a whelk-shell, only the spire is more elongated and drawn out. In cases where closure of the mouth is brought about by spasm induced through the painful eruption of a wisdom-tooth, occurring as it does in early life, the teeth in the front of the mouth are almost always firm, and would readily bear the wedging force. Upon introducing the point of Mr. Maunder's "gag"* between the incisors, or canines, or premolars, and slowly turning the instrument, it evenly and in regular progress, separates the jaws, and, as I have thought, with quicker results than any other method.

III. *Tumours of the gum and tooth-pulp.* (a) Epulis: (b) Congenital hypertrophy of the gum and alveolar borders of the maxillæ: (c) Polypus of the gum: (d) Vascular tumours: (e) Polypus of tooth-pulp: (f) Sensitive growth of pulp after fracture.

* In operating on the mouth, under the influence of chloroform, it is very often necessary to gag open the mouth. I have seen no apparatus by which this is so effectually accomplished as Mr. Maunder's; indeed, it was to meet these requirements in the use of chloroform that this plan was devised.

Epulis. "The term 'epulis' has been vaguely applied to various tumours that are found in and beneath the gums. The etymological meaning of the word (*ἐπὶ, upon, οὐλα, the gums*), entirely referring to position, and not to structure, is likely to have caused and to continue this confusion. Where, however, distinction has been drawn, it has been applied to those hard and densely fibrous tumours that arise from the surface of the alveolar processes, involving the periosteum, and by their expanded growth stretching the otherwise healthy gum over them. These are essentially different in origin, history, and anatomical structure, from the loose flaps, and often pedunculated masses of gum, mere hypertrophied integument, that are not unfrequently seen in the neighbourhood of decayed teeth, and to which the designations 'polypus' and 'fungus' of the gum have been appropriately given."*

An epulis tumour consists of a hard dense mass growing slowly and evenly from the edge of the alveolar process usually between two standing teeth, and more commonly on the labial or buccal aspect than the lingual. The point at which this growth generally makes its first appearance is beneath and involving the little tongue of gum which exists between the necks of two contiguous teeth: as it progresses in size, it displaces the neighbouring teeth, one usually more than the other: it has for the most part a broad base, and increases in basal area more than in projecting growth. The situation in which an epulis commences is liable to a good deal of variety: though usually at the free edge of the alveolar process, it may form at a distance from it; but I believe it is always associated with porous vascular bone, nearly connected with the periodontal membrane, and does not spring from the compact tissue limiting the outline of the bone. The growth sometimes commences in the tooth-socket. As I have remarked, the *endosteal* membrane shares in the genesis of an epulis tumour, and the fibrous growth appears to burrow, so to speak, into the substance of the bone, producing a general expansion of the whole structure. The surface of the tumour is like that of the surrounding gum; it is, however, sometimes mottled, and not infrequently slightly but broadly and flatly lobulated. It is as insensitve as the surrounding gum, and is not liable to bleed; when manipulated, it is tense and elastic. The tumour varies in size indefinitely—from the size of a pea to that of a walnut, or larger. It is generally stated that epulis tumours are more common in the upper than the lower jaw: this coincides with my own expe-

* *Specimens of Epulis*, by S. J. A. Salter, *Trans. Path. Soc.* vol. v. 1854.

rience. I happen to have met with them in the proportion exactly of two of the former to one of the latter. The epulis tumour appears to have a certain relation to the teeth in whose neighbourhood it forms. It almost always makes its appearance where there *are* teeth: it usually invades one in a very marked degree more than any other near which it may be situated, by dislocating it and pushing it out of place: it has nothing to do apparently with caries of the tooth: the removal of the particular tooth, with excision of the tumour, is almost always accompanied by immediate and complete cure of the disease.

Occasionally these tumours appear where teeth have been removed and the gum seems to be edentulous: it will, however, generally be found in these instances that a fang of one of the teeth has been left behind, and is associated with the irritation that has caused the morbid growth. One of the most severe examples of this malady, which I have seen, consisted of a bi-lobular mass, the size of a large walnut, extending, on the left side of the lower jaw, from the dens sapientiæ to the canine tooth, the four intermediate teeth having been removed. The excision of the tumour had been repeatedly performed, but it always returned. Its removal on this occasion disclosed the remains of one fang of the first molar tooth in its very axis: this was extracted, and the disease did not again make its appearance. I believe this will generally be found the case where the tumour forms upon an apparently edentulous region of the jaw. Epulis has its origin in the osteal membrane of the alveolus. The bone of the alveolar processes is very vascular, and almost cancellated in its loose open structure. The endosteal membrane which lines this cancellated bone, the periosteum which covers it, and which lines the tooth-sockets and the fibrous tissue of the gum, are all continuous, and alike share in the development of an epulis tumour. The bulk of the tumour consists of a dense web of fibrous tissue; and from its basal attachment, and passing into its substance, are usually small growths of bone. The fibrous tissue interlaces pretty regularly—some fibres being parallel to the surface, and others radiating from the base, intersecting the former at right angles. The bone-growths may be thin needle-like spicula or little flakes: at the point whence these bony processes arise, the tumour receives its main vascular supply, and the subjacent bone is very porous. Mr. Caesar Hawkins mentions an instance of an epulis attached only by a pedicle to the gum, in which there was a nucleus of bone. This could not at any time have had bony union with the jaw; but the

circumstance indicates, in a physiological sense, the osteal character of these fibroid developments. Epulis tumours are perfectly innocent, nor do they, I believe, ever pass into a malignant character. Sometimes, though rarely, they ulcerate on the surface; but this is only under the influence of external agencies, such as produce ulceration of any portion of the gum: they may then become painful.

The histology of epulis tumours is consistent with their history—locally recurrent as long as the circumstances under which they occurred are maintained, destroyed by the removal of their local nidus, and never impregnating the system. Epulis tumours are always, I believe, a form of “fibro-plastic;” a combination of fibrous tissue and myeloid cells, the proportion of the two constituents varying indefinitely. In general, the main bulk of the tumour consists of fibrous tissue; but sometimes the myeloid-cell element preponderates, and may form the major portion of the growth.*

The *treatment* of epulis is very simple: it requires early and complete extirpation with the knife, and according to the extent and inveteracy of the case it may also need the removal of contiguous teeth and subjacent bone. These latter circumstances refer to an important circumstance in the *pathological history* of the disease: it is this, that as long as the alveolar process remains upon which the tumour grew, and which must necessarily be as long as the teeth which are implanted in it are not removed, so long will the tumour be inveterate, so often will it return (at least generally), however accurately and carefully it may have been removed. But when the alveolar process is gone, it shows no tendency to return. And it is a remarkable circumstance, that the spontaneous absorption of the alveoli that follows the extraction of the teeth is of itself, *in many instances*, where the disease is confined only to these processes, enough to prevent its recurrence. That is to say, if the tumour be removed to a level with the gum, and the contiguous teeth be extracted, the alveolar process vanishes by absorption, and the disease no more returns; though the same operation, without the removal of the teeth, may have been performed unsuccessfully any number of times previously. In a first operation when the disease is of limited extent, it will be well to try the result of its simple removal by the scalpel without the extraction of

* *Specimens of Epulis*, by S. J. A. Salter, loc. cit.; *Myeloid Epulis of Lower Jaw*, by J. Hutchinson, *Trans. Path. Soc.* vol. viii.

teeth or the cutting away of more bone than can be accomplished with the knife. The bone about the base and axis of the tumour being vascular and spongy, the knife readily cuts away small portions. Any subsequent sprouting of granulations in an undue or threatening degree should be checked and repressed by some caustic, and for this purpose nitric acid has been especially recommended. If the disease recurs, as it too often does, the same operation should be repeated, and accompanied by the extraction of a tooth or teeth whose socket or sockets have been implicated. Unless the disease have a deep hold on the bony substance of the jaw, it will seldom be necessary to cut away any large amount of bone; sometimes, however, this is the case, or the growth may have started deep in the socket of a tooth. In such an instance it may be necessary to extirpate a considerable amount of bone. A V-shaped portion or a cubical mass may be readily cut out by means of a Hey's saw and bone-nippers, according to the form and extent of the particular tumour. It will never, I believe, be necessary to go far below the limit of the alveolar process; for it is with the alveolar bone that the disease is essentially connected. In the lower jaw I would urge the necessity of never cutting through the entire bone, as the breaking of the maxillary arch most seriously interferes with the position of the remaining portions of the bone, and thus disturbs the normal opposition of the teeth in the two jaws relatively.

Congenital hypertrophy of the gum and alveolar borders of the maxilla. In 1859 I had an opportunity of seeing a very remarkable example of disease, which is, perhaps, best defined by the above title, under the care of Mr. Pollock, at St. George's Hospital. At that time there was, I believe, no recorded example of this curious tumour-like growth; nor had any instance of it been published, as far as I am aware, until early in the present year, when a case was described and figured by Gross, in the second edition of his *System of Surgery*.* The two cases are not only the same in essence, but are singularly alike in all particulars.

Mr. Pollock's patient at the time of her admission into the hospital was eight years old. At birth nothing was noticed unusual in her mouth, but a fortnight after a tooth was cut, and by the fifth week six had appeared. It was then remarked that the gums were full and thick, and puffy. They continued to increase in bulk, and

* *A System of Surgery, &c.*, by S. D. Gross, M.D., Philadelphia, 1862, 2d edition, vol. ii. p. 535, fig. 330.

at two years of age they were cauterised, and all the temporary teeth which had appeared were extracted. At birth the child had an unusual quantity of hair on the head, and also much on the arms and legs: when taken into the hospital this peculiarity was very striking; the hair of the head was coarse and rank, and grew low on the forehead, and in front of the ears on to the cheeks. The arms and legs were covered with hair. The patient was epileptic.

Before any operation was performed, the girl presented a most extraordinary appearance. A large mass, pink and smooth, protruded from the mouth, which the lips did not and could not cover. It was slightly corrugated or indistinctly lobed; the structure was very dense, inelastic, and insensitive, and appeared skin-like on the surface. The greater bulk proceeded from the upper jaw, and was most developed in the front of the mouth; but the same condition appeared along the whole edge of both jaws, that of the lower jaw being less, and covered and overlapped by the upper.

In structure, this hypertrophied mass consisted both of an expanded and prolonged development of the alveolar borders of the maxillæ, and an immense thickening of the fibrous tissue of the gum, with a proportionately exuberant growth of the papillary surface. The removal of portions of the mass by surgical operation gave opportunities of examining its precise nature. In the front of the upper jaw, where the development was greatest, the fibrous mass extended in some places more than three-quarters of an inch beyond the alveolar edge, which it thus covered in with a dense cushion. Those of the temporary teeth which had not been extracted were deeply imbedded in the mass, the crowns of the second lower temporary molars being the only ones which were now visible. The crowns of all four of the six-years old teeth (first permanent molars) had appeared on account of the slightness of the hypertrophy towards the back of the mouth. A section of parts of the removed mass displayed the remaining temporary teeth completely clothed with the thick fibrous growth, the fangs embedded in sockets, but the crowns free of bone and each closely surrounded by a serous-like chamber without any communication with the surface. One of the superior central incisors was more deeply covered than any other teeth, and was nearly an inch from the surface. The fangs of the permanent teeth were developed in accordance with the age of the patient; but I observed that the crowns were still encased in the *bony* loculi, though from the age of the patient the distal wall of the bony capsules should, in many of them (incisors and first premolars), have been absorbed. In the socket of the first temporary

incisors a small absorbed orifice existed, leading into the locus of the permanent tooth, such as is usually found about five years old.

But the most remarkable point of structure in this growth was the papillary surface. The epithelium had changed into a very thick and hard epidermis, beneath which, and evenly covered in by it, were enormously long papillæ. The papillæ of gum vary from about $\frac{1}{7.5}$ to $\frac{1}{3.5}$ of an inch in length normally; but in a section, vertical to the surface, they here appear from the $\frac{1}{6}$ to the $\frac{1}{4}$ of an inch; and when by maceration the outer epiderm has been removed, the papillæ stand up like the pile of plush or velvet, and may be brushed from side to side by the finger. Kölliker* has noticed that in the mouths of edentulous old people, whose bare gums are exposed to the rough attrition of food, the papillæ become much enlarged and elongated, attaining sometimes the $\frac{1}{1.5}$ of an inch in length; and here, under exposure to still more physical violence, the same change has taken place to a vastly greater degree. But I apprehend that this monstrous development of the papillæ has also another meaning, and that it is an essential element of the disease; it is quite in keeping with the rough and thick skin of the patient, the abundant development of coarse hair over the surface, and also the enormous teeth. The permanent teeth which were removed by the operations are excessively large, especially the superior central incisors; these are larger than any I have before seen removed from a female mouth. All these circumstances imply a tendency to a general tegumentary and papillary hypertrophy.

Treatment. The proper treatment of this disease is obviously that which was followed by Mr. Pollock and Dr. Gross in their respective cases. Portions of the projecting mass were cut away with scalpels and bone-nippers till the alveolar borders were curtailed to within moderate limits. The operation was not completed at once, but was performed in detail, as the patient could bear it. In both instances there has been a slight tendency to a fresh growth where the hypertrophied masses were removed.

Polypus of the gum. The gum is liable to a simple hypertrophy, the increase of growth—a sort of mucous tubercle—being confined to the gum structure alone, and not involving the osteal membrane, nor complicated with a growth of bone. The little tongues of gum between the necks of the teeth are liable to this affection, especially towards the front of the mouth; and they sometimes grow to such

* *Mikroskopische Anatomie*, &c., von Dr. A. Kölliker, Leipsic, 1854, vol. ii. p. 85.

an extent, being confluent with those on either side, as to cover a considerable portion of the crowns of the teeth. This condition is usually associated with uncleanly habits; and may be generally cured and prevented hereafter by simple and easy means. The teeth should be thoroughly cleansed from tartar; the gums may be scarified: for the future the teeth should be abundantly brushed with a stiff brush, and the mouth washed with an astringent lotion, of which solution of permanganate of potass may form an ingredient. I have seen a modification of this condition, which was evidently syphilitic; the growths of the gum were *condylomatous*, and were more or less covered with very painful superficial ulcers. The symptoms readily yielded to the internal administration of iodide of potassium, and the application with a camel's-hair brush of a solution of nitrate of silver, 10 grs. to ℥j. aquæ. Hypertrophy of the gum of a truly polypus-like form not infrequently occurs in the immediate neighbourhood of teeth which are carious at their sides, and when the caries reaches the neck of the tooth: the irritation of the contiguous dentinal disease seems to stimulate this unwonted growth, and the mucous membrane bulges into the cavity and fills it up. The cavities of two teeth carious on their contiguous surfaces are very apt to be associated with this condition, the little polypus of gum between them rising to their masticating surfaces. Such tumours are more or less pedunculated; they have a red fleshy look, and are very liable to bleed when roughly touched. The structure of these growths is in consonance with their aspect and the ease with which they bleed; they consist principally of hypertrophy of the true mucous-membrane element of the gum, especially the papillary structure: the epithelial covering is rather diminished in proportional amount, while the papillæ themselves become enormously elongated and increased in diameter, and some of the conical papillæ develop into the compound fungiform variety. These changes are accompanied by great dilatation of the capillaries which loop into the papillæ.

Polypous growths of the gum are so generally dependent on the state of the contiguous teeth, that their treatment involves that of the teeth also. If the polypus is extirpated, it will most probably return till the tooth itself is removed, or the condition of the tooth which had irritated the gum has been remedied. The caries should be cut away; ragged or sharp edges of tooth-substance should be smoothed and blunted, and the remaining cavity should be filled. The gum may still show some tendency to renewed sprouting, and this may be kept down for a time by the repeated application of a

strong solution of nitrate of silver, sulphate of copper or alum, when it will probably assume a healthy aspect. If the removal of the polypus is accompanied by the extraction of the offending tooth, I believe it never returns.

Vascular tumours. The tissues about the necks of the teeth are obnoxious to the growth of vascular tumours, which vary from passive *naevus-like* swellings to those other forms of more arterial character,—*aneurisms by anastomosis*. I have met with both these forms of the disease. The most common position in which it develops itself is in the front of the upper jaw, between the incisors, or canines and lateral incisors. A rather severe instance which occurred recently under my care manifested itself in the region that should have been occupied by the left lateral incisor of the upper jaw; but, as the laterals were wanting in this person, the tumour formed between the canine and central incisor. It had been about six months in reaching its present size, the dimensions of a large marble, flattened on the surface. It was of a purplish colour, streaked with many vessels on the surface; it was easily compressed, but was elastic, and when pressed it became pale, exsanguine, and much reduced in size; upon removing the pressure, it resumed its previous aspect in a pulse or two. The surface of the growth was tolerably smooth; the base somewhat constricted, being about one-third less than the head of the tumour. The whole of the gums were very red, turgid, and swollen, and the little tongues of gum between the necks of the teeth much enlarged and spongy. The patient had suffered no pain, but was conscious of a constant throbbing and pulsation. The most important symptom, however, was the hæmorrhage, which had latterly become a serious source of trouble and distress; it usually occurred at night; it would ooze from the mouth and stain the pillow and sheets, and sometimes trickle into the glottis and cause momentary suffocation.

The treatment which I first adopted in this case was determined by the very *arterial* character of the tumour. I attempted to destroy it by ligature: a needle armed with a double thread was passed through its base, and each portion of the thread was tied so as to strangulate half of its attachment. The ligatures were tied tight, but did not cut through the substance of the growth. Their effect was for the time to produce complete strangulation: the tumour was tense, and the blood could not be squeezed out of it by pressure. This plan did not ultimately succeed, for the size was not permanently diminished and the circulation was reëstablished. I next removed the tumour by a very tight ligature, cutting it clean

off; after this it returned as before, and I finally extirpated it with the scalpel, cutting freely inwards, so as to remove a portion of the spongy vascular bone which seemed to form its basal axis. The bone at the base of these growths appears always to be very vascular and open in its texture. Considerable hæmorrhage followed the operation, which ceased under cold and pressure. For a few weeks the cicatrix furnished freely-sprouting granulations; these were abundantly cauterised twice a week, and ultimately yielded a healthy scar. In structure, this little mass, when removed, displayed a complicated vascular net-work, which, under the action of acetic acid, with the microscope, exhibited little else than an elaborate aggregation of the nuclei of blood-vessel muscle-cells. The surface was clothed with epithelium and papillæ, like the gum. I believe that no danger can arise in these cases from the use of the knife in at once extirpating the tumour; the bleeding may be profuse for a minute or two, but it soon ceases.

I have seen a vascular tumour connected apparently with the periosteum of a loose molar tooth, in which the hæmorrhage was very severe, occurring also at night to an extent that was really alarming: the tumour was a tense pedunculated mass, attached to the side of an upper molar tooth, half of the fang of which was naked. The extraction of the tooth brought away the tumour with it, which immediately shrivelled up to half its previous volume, and became soft and flabby.

These tumours, as far as I have observed, occur in adult and middle life; they are perfectly innocent, and show no tendency to return when carefully eradicated.

Polypus of the tooth-pulp. In carious teeth the tooth-pulp is occasionally developed into a polypus-like growth, that fills more or less the diseased cavity. This formation is a dense, gristly, pink-coloured mass, consisting of a modification of the original dentine-forming organ: it is always attached by a constricted base to the pulp in the canal of one or more of the fangs; the mass itself is usually more or less rounded, frequently corresponding in form exactly to the carious cavity which contains it; sometimes, by a more exuberant growth, it is forced into a polyhedral shape by the contiguous structures, whose pressure curtails its further enlargement—the masticating surface of the opposing tooth in the other jaw, the distal and proximal neighbours of the tooth from which it has sprung, the tongue and the cheek; such cases as these usually occurring where the walls of the original tooth have completely broken away, leaving a distinct interval bounded by the parts I

have named. In such examples it may be difficult to an inexperienced observer to make out the nature of the tumour; it may be mistaken for an *epulis*, or a gum polypus; search for the remains of the decayed tooth will settle this doubt. This polypus is very callous and insensitive to pain; it is not liable to ulcerate or bleed; but it discharges pus from its surface, especially when in contact with the walls of the carious tooth in whose cavity it forms. In structure these polypi approach, in the majority of instances, very closely to the ordinary granulations of a healing sore, consisting superficially of a mass of exudation corpuscles, through which are distributed multitudes of capillary loops, and more deeply of a fibrous tissue into which these cells have developed. In these instances the most superficial cells appear to be shed, assuming the form and aspect of pus. Rarely these granulations seem to heal, to cicatrise; and I have found a few instances in which the surface of the polypus has been clothed with a dense cuticular epithelium overlying a basement membrane folded into true papillæ. Polypus of the tooth-pulp "most often occurs in young people, and in those in whom the teeth are imperfectly calcified, presenting that peculiar globular calcification in which the substance of the dentine becomes rapidly sodden with saliva, and carious without limit from the enamel to the pulp." "The physiological phenomena displayed by polypus of the pulp are very remarkable as regards both the pulp itself and the tooth,—their oppositeness to the whole train of circumstances which accompany the ordinary inflammation of the pulps dependent on caries, odontalgia, lymph-deposit on fangs, alveolar abscess, &c. . . . The pulp never undergoes intrinsic calcification, nor have we any evidence that dentine of repair is ever formed."*

The treatment of this condition is very simple. If the polypus is cut away, it will certainly return; caustics and the like applications appear to have no influence in repressing it. If the tooth be extracted, it is finally eradicated; and this plan should always be adopted.

Sensitive growth of pulp after fracture. This condition only occurs, as I believe, when a tooth with a healthy pulp is suddenly fractured by mechanical violence. When a pulp is thus exposed, it exhibits intense sensitiveness to touch, to cold or heat, or indeed to any external influence; and it frequently sprouts into a small excrescence. This excrescence is paler than an ordinary pulp-

* *Polypus of Tooth-pulp*, by S. J. A. Salter, *Guy's Hospital Reports*, 3d series, vol. iv.

polypus, and is of a semi-transparent aspect; it is often complicated on the surface, and villus-like: when removed, like the other form of pulp-growth, it certainly returns, and of the same character as before. In microscopic structure this sprouting of the pulp differs little from the insensitive polypus; but its vitality implies a more abundant nervous supply—vascular granulations appear to the observer to constitute its histological elements. This condition remains as a permanent torture to the patient, till the tooth is extracted, when it is of course completely removed. I have known this state of tooth-pulp form a very distressing complication in a case of fracture of the lower jaw, in which a bicuspid tooth was broken and the pulp exposed: here the apparatus for fixing the displaced bone, and the introduction into the mouth of food, were attended with agonizing pain, which continued till its source, a fractured tooth with a quick pulp, was discovered and extracted. Afterwards the treatment of this fracture was successfully and painlessly prosecuted. The possibility, indeed occasional probability, of such a complication, in treating fractures of the maxillæ, should be borne in mind by Surgeons; and it should be especially remembered, that when extreme sensitiveness and pain manifest themselves in such cases, a fractured tooth should be sought for.

IV. "*Abscess*" of the antrum. The term *abscess* of the antrum conveys a very wrong impression of the real nature of this disease; it is not the suppuration of inflamed parenchyma, but the occlusion in a cavity of the purulent secretion from the surface of a mucous membrane which lines that cavity. I need not dwell on the anatomical characters of the antrum maxillare further than to notice its peculiar relations to those organs, the teeth, whose affections are by far the commonest cause in the production of the malady we are considering. These relations vary extremely, both as regards the extension of the antrum over the fangs of many or few teeth, and the degree in which those fangs approach or pierce the floor of the sinus. It may extend so as to be in immediate relation to all the teeth of the true maxilla from the canine to the dens sapientiæ, or it may be contracted to such narrow limits as only to correspond with two or three of the central ones. This variation in the size of the antrum is not mentioned in text-books of anatomy, but it is pointed out by Otto.* Occasionally a root or roots of the first molar tooth (rarely

* *Lehrbuch der pathologischen Anatomie des Menschen und der Thiere*, von Dr. A. W. Otto, p. 180, Berlin, 1830.

any other) extend into the cavity, free of any bony covering, and merely overlaid by the mucous membrane lining the sinus; more often, however, the palatine and external roots diverge so as to leave an interval between which the more depending sulcus of the antrum is excavated. Another circumstance in the anatomy of the antrum bearing on the purulent accumulation which constitutes abscess of this sinus is the very variable size of the orifice which opens into the middle meatus of the nose. In some instances the aperture is barely sufficient to admit the blunt point of a probe; in others it would allow the passage of the end of the little finger. It is always much smaller in the living state when the mucous membrane lines and fills up the opening; indeed it is the pouting of the tumid mucous membrane which closes the orifice in inflammation. The lining membrane of the antrum is liable, like all other mucous membranes, especially the Schneiderian membrane, of which it is a continuation, to inflammation and altered secretion, mucus being impregnated with or replaced by pus, and accumulating in quantity. This may occur in different degrees, both as to amount and rapidity of development; but the circumstance which here gives importance to this altered and more abundant secretion depends entirely upon the fact that it may become occluded within the sinus by means of the swelling and turgescence of the mucous membrane around its orifice. This, from such anatomical arrangement, converts a mere catarrhal inflammation, spending itself by superficial pus-shedding, into a shut expanding sac, in many respects equivalent to a deep-seated abscess, though by no means identical with that condition either in pathological history or absolute anatomy.

The *causes* of abscess of the antrum may be enumerated in very narrow limits. I believe that in adults, in the majority of cases beyond all computation, it is produced by dental caries, or at least by alveolar abscess, in some stage, associated with tooth-disease. It is stated that the affection may be brought on by a blow on the cheek; and an instance has been recorded in which the malady has occurred in a new-born child, and supposed to result from the pressure on the cheek during a hard labour.

The *symptoms* of antral abscess vary much in degree; but they usually commence by dull aching pain in the cheek, with heat, redness, and fulness of the soft parts externally. In the early stage there may, or may not, be a purulent discharge from the corresponding nostril; this, however, can only occur to any marked extent before the aperture between the middle meatus and the sinus is closed. As the case advances and the matter becomes pent up, the pain as-

sumes a throbbing character and is severe, and constitutional symptoms manifest themselves analogous to those of acute abscess; the patient has rigors and fever. With this the local symptoms change, and an expansion of the whole jaw shows itself; the malar bone becomes elevated, the fossa beneath it full and prominent; the molar teeth on the affected side appear to elongate, and, in closure of the mouth, meet their opponents too soon; the concavity of the hard palate becomes flat or even convex; the nostril of that side is more or less closed, and, in severe and protracted cases, the floor of the orbit becomes so pushed up as to protrude the eye. Hunter, in describing the symptoms of antral abscess, speaks of the eye being sometimes "affected;" but in what manner he does not specify. Beyond instances in which protrusion of the globe* has occurred few have been recorded. The inflammation accompanying abscess of the antrum is, however, occasionally so severe as to implicate the periosteum, not only to the destruction of some parts of the maxilla, but extending beyond to contiguous fibrous structures, so as to involve the optic and other nerves in their passage from the cranial cavity to the orbit, producing blindness and fixedness of pupil on the affected side. Such cases are very rare; but one has occurred in my own practice at Guy's Hospital;† a second was under the care of Mr. Pollock; and a third is mentioned by Dr. Brück in Casper's *Wochenschrift*.‡ Necrosis of part of the jaw is one of the rarer accompaniments of this malady; but when any portion of the bone is affected, it is usually either the alveolar processes or the nasal plate of the maxilla.

The manual examination of the jaw seldom fails to indicate the fluid nature of the distending material; fluctuation can be felt, and the thinned bony parietes of the abscess convey to the touch a peculiar sensation, like the handling of dry parchment: as Jourdain very characteristically expresses it, "quand on appuyoit sur l'os, il s'affaïssoit et revenoit ensuite sur lui-même en produisant une espèce de craquement."§ If any doubt does arise as to the nature of the contents of an expanding antrum, I am in the habit of exploring the cavity with a minute trocar and canula not above half the size

* An extreme case is mentioned by Frank, *De Curandis Hominum Morbis*, &c., auctore Joanne Petro Frank, lib. vi. pars 2, p. 22, Viennæ, 1820.

† "Case of Amaurosis from Abscess of the Antrum caused by a carious Tooth," by S. J. A. Salter, *Med.-Chir. Trans.* vol. xlv.

‡ *Wiederholte Entzündungen des Antrum Highmori und Amaurose*, &c., mitgetheilt vom Dr. T. H. Brück, in Casper's *Wochenschrift*, März 1851, Berlin.

§ *Traité des Maladies, &c. de la Bouche*, par M. Jourdain, t. i. p. 120, Paris, 1778.

of a wheaten straw ; by this means sufficient fluid, if present, may be made to escape to ascertain its nature, and it could scarcely do injury to a solid growth if such were the character of the expansion. A grooved needle would answer the same purpose, but hardly so readily. The fluid may be too dense to pass these narrow canals ; generally, however, it is not thicker than ordinary pus, and it is sometimes serous.

The ultimate issue of these cases varies very much. Occasionally the abscess bursts into the nose ; sometimes through the cheek ; occasionally into an alveolar cavity, burrowing along the fang, and discharging its pus at the neck of the tooth. More rarely the floor of the orbit gives way, and the pus finds its exit somewhere along the lower lid. Occasionally the orifice which communicates between the antrum and the nose yields temporarily, and there is an accommodating escape of pus ; as the patient lies on the other cheek, pus will stream from the nostril of the affected side and then stop, and again make its escape by the same exit.

The *treatment* of this malady is so admirably sketched out by Hunter that I cannot do better than quote his own words :

“ The first part of the cure, as well as that of all other abscesses, is to make an opening, but not in the part where it threatens to point ; for that would generally be through the skin of the cheek.

“ If the disease is known early before it has caused the destruction of the forepart of the bone, there are two ways of opening the abscess : one by perforating the partition between the antrum and the nose, which may be done ; and the other by drawing the first or second grinder of that side, and perforating the partition between the roots of the alveolar process and the antrum, so that the matter may be discharged for the future that way.

“ But if the fore part of the bone has been destroyed, an opening may be made on the inside of the lip, where the abscess most probably will be felt ; but this will be more apt than the other perforation to heal, and thereby may occasion a new accumulation ; which is to be avoided, if possible, by putting in practice all the common methods of preventing openings from healing or closing up ; but this practice will rather prove troublesome ; therefore the drawing of the tooth is to be preferred, because it is not so liable to this objection.”*

Before the abscess has formed, and when, as yet, it is only

* *Practical Treatise on the Diseases of the Teeth*, by John Hunter, 4to, London, 1778, pp. 45, 46.

imminent, it may be arrested by removing any carious tooth or teeth in the neighbourhood; and the application of leeches, fomentations, &c., with the administration of purgatives. In those cases where the pus has already accumulated, and there is no outlet, it will be necessary to make a free opening for the evacuation of the matter; and the method, which universal experience has approved, consists in the removal of a tooth, and the perforation of the antrum at its base. This has the double advantage of removing the cause in most cases, and of allowing the discharge of the matter at the most dependent part of its containing sac. The tooth whose fangs are usually most intimately associated with the antrum is the first permanent molar; and its removal, in a case of antral abscess, is especially indicated from this circumstance, and from the frail and perishable nature of the tooth itself, which gives it less often than other teeth a long tenure of usefulness. The relation of the fangs of the molar teeth to the antrum is an important consideration in the treatment of this disease: in the largest proportion of cases caries of the first molar is the cause, and its removal (opening an alveolus for further perforation) is the first step in the treatment; but any other tooth, molar, bicuspid, or even canine, whose disease should be considered its cause, ought in preference to be extracted, as the absorption around the fang of a carious tooth would render the perforation of the antrum easy, while, by such a selection, this preliminary step would remove the exciting cause of the disease. Indeed, as a rule, it is well to extract all carious teeth from the side of the upper jaw affected with antral abscess. The extraction of the abscess-causing tooth is frequently followed by discharge of the contained pus, in consequence of the fang having extended into the antrum, or the floor of the sinus having been absorbed, resulting from the diseased tooth. It is generally necessary to enlarge the orifice into the antrum; and this is best effected by a naked trocar pushed up the socket of the extracted tooth: the trocar should be large, so as to break down a good deal of the floor of the antrum, thus making a free orifice for the discharge of matter. The absorption of bone which occurs around the fangs of carious teeth much facilitates piercing the antrum in this manner. Perforating the antrum occasionally requires considerable force; and it is necessary to apply this force with great care: the fore-finger should be extended on the shaft of the trocar as a guard, and the instrument should be pressed forwards with an even rotating motion. If these precautions are not taken, the floor of the antrum will sometimes give way suddenly, the trocar will traverse the cavity of the

sinus, and strike hard against the floor of the orbit, which it may even pierce. The author once saw this accident occur in the hands of a young operator, fortunately without any serious consequences. Occasionally antral abscess is associated with necrosis of some portion of the walls of the sinus; and if this should occur near its floor, the removal of the dead bone will supply an available orifice for the discharge of matter and the employment of injections. The presence of necrosed bone gives to the discharge the peculiar characteristic odour which is familiar to every Surgeon: the offensive smell which the pus has, when simply long pent up, is a putridity of staleness, and quite distinct from the dead-bone foetor. It may not be always easy to remove dead bone at once; and, in such a case, an outlet may be made in its neighbourhood, which will allow the discharge of the matter, and assist in the coming away of the sequestrum when it is detached. If a case were to occur in which the teeth have been long removed, and the alveolar processes absorbed, the floor of the antrum would be more difficult to pierce, on account of the thick compact layer of bone which is constituted by the *osteal cicatrix* after the removal of the teeth. In such a case it would be more easy to enter the antrum by perforating at the base of the malar process of the maxillary bone over the region formerly occupied by the second or third molar tooth. The mucous membrane should be divided first; and then the bone, when quite exposed, perforated by means of any instrument suitable for the purpose: a large trocar; or, as Sir B. Brodie suggests, a strong pair of scissors, closed, and held firmly in the hand, should be *bored* into the part chosen for perforation.

When the antrum has been perforated, the next step is to secure the complete washing out of the cavity by injections, and the free and continued egress of the discharge by the artificial opening. Warm water should be abundantly used at first, so as to remove all the matter, which is sometimes inspissated. This will give great relief, and the swelling and inflammation will usually subside at once. Should the tendency to pus-secretion continue, an injection of sulphate of zinc, or what in an obstinate case I found very efficacious, a solution (gr. ij. to the ounce) of nitrate of silver in distilled water, may be employed. I am in the habit of using a glass syringe with an ivory nozzle; fitted to the extremity of this is a bent silver tube. In using this apparatus, the silver tube is introduced into the opening in the antrum, and kept there while the syringe is filled and used; and withdrawn, refilled, and used again, many times. When the washing out of the antrum is completed, both the syringe and

the silver tube are withdrawn; and now, unless some means are taken to prevent it, accidents of two kinds may occur;—first, food may pass through the orifice into the maxillary sinus; and secondly, the aperture, thus artificially made, may close and cicatrise over. To prevent this, the plan usually adopted has been, to plug the orifice with a piece of wood, which effectually prevents both ill consequences. This is, however, a clumsy method: the same and further advantages may be gained by adopting a plan which I have followed in some recent cases. After the perforation through the alveolar cavity has been made, I have taken a model, and a plate has been prepared to pass over the space occupied by the extracted tooth, and fastened to the contiguous teeth by the customary metallic bands. Through this plate a hole has been bored, which corresponds to the orifice into the antrum; and to the applied surface of the plate a very short tube has been soldered, sufficiently long just to enter the antrum, to occupy the perforation, and prevent its closure. This plate has been permanently fixed during the active treatment of the case, and the orifice in the tube has been kept closed by a plug of cork in the intervals between using the injection. By the removal of the cork, the nozzle of the syringe, which fitted the tube, could be applied, and the injection used any number of times, the tube being sufficiently short to allow the complete washing out of the cavity and the escape of the fluid. This plan of treatment has the additional advantage, that when there is no further need of keeping open the artificial orifice, the plate over the gum facilitates its closure. By removing the tube, and closing the hole by a little sheet of metal soldered on, the passage of air and fluid from the mouth to the antrum is suspended, and the healing of the wound is thereby facilitated, as will be hereafter explained. (See section on the Application of Obturators, &c.)

If in operations for antral abscess any foreign body, which may have caused or be associated with it, such as the fang of a tooth, becomes loose in the sinus, it should be remembered that the cavity is occasionally divided, as shown by M. Giraldès,* by partial septa of bone projecting from its walls. In such an instance, the adventitious body may be pocketed in a circumscribed region of the sinus,† and can only be removed by some curved scooping instrument introduced into the antrum; and this septate condition

* *Des Maladies du Sinus Maxillaire*, par M. Giraldès, Paris, 1851.

† An interesting example of this casualty is mentioned by Mr. Cattlin, in the *Transactions of the Odontological Society*, vol. ii. p. 38, London, 1861.

too would materially interfere with the cleansing of the cavity by means of injections.

V. *Dentigerous cysts*. Dentigerous cysts are collections of serum, or some modification of serum, occurring in the maxillary bones, associated with and dependent upon impacted misplaced teeth.* These serous cysts may result from the presence of a supernumerary tooth or teeth; but in every case recorded, and in all except one that have come within my knowledge, the tooth or teeth have been normal in their presence and serial character, though misplaced as regards position: further, in every recorded case, the tooth or teeth thus implicated in disease, have been of the successional or permanent set, though a solitary instance has happened in the practice of a friend of the author's, in which a temporary tooth was the dental element of one of these cysts. These tooth-bearing

* The dentigerous cysts, to which I have above referred, are totally distinct in their origin and physiological meaning from those other tooth-bearing tumours which are found, some in the ovaries of females, and others variously distributed in the bodies of either sex. The dentigerous cysts occurring in the jaw are merely the result of misplacement of a tooth, or tooth-germs belonging to the jaw which contains them. The two other forms of dentigerous cyst neither belong to the individual in whom they are found, nor are they adventitious growths of disease, properly so called. They obviously represent a portion (more or less) of another individual, and indicate some curious aberration of the function of reproduction. The ovarian tumours which bear teeth, and many foetal structures found in the ovary of the human female, I conceive to be the absolute equivalents of the virgin-produced "zooids" of those invertebrata which perfect the function of *parthenogenesis* in the reproduction of their kind; that the development of these so-called tumours is the physiological equivalent of this function, though the anatomical result is incomplete. (See *Ovarian Tumour containing Teeth*, &c., by the author, in *Guy's Hospital Reports*, 3d series, vol. vi.) Those other tooth-bearing tumours which are found in various parts of the body, irrespective of sex, cannot be susceptible of the same explanation, but suggest the entanglement of an imperfect, or more or less perfect, ovum within the primary one. Teeth appear to be the most constant of the structures entering into the formation of these tumours; but they are associated with other tissues, even in more than one instance to the production of an entire foetus. These developments receive a probable elucidation by those curious monstrosities occasionally noticed in the ova of birds, in which a small imperfect egg is found *within* a larger primary one,—not the common monstrosity of *twin* yolks in one egg, but a distinct miniature egg *within* the larger. (See Retzius, in *Oefversigt af Kongl Vetenskaps—Akademiens Förhandlingar*, Stockholm, 1847; Baron de Morogues, in *Revue de Zoologie*, 2^e série, t. v., Paris, 1853.) Such a circumstance occurring in the human ovum may explain the presence of these dentigerous and many-tissued cysts enclosed within the body.

serous tumours are, therefore, to be looked upon only as the occasional complications of dentition, in which there is an accidental deviation in the anatomical position of some tooth or teeth. The cysts only arise when the tooth or teeth associated with them are imbedded in the substance of the jaw-bone; they do not occur after the tooth has pierced the gum. The embedding of a tooth in the bone does not necessarily give rise to these serous collections, for that is by no means an uncommon occurrence, whereas dentigerous cysts are rare. There appear to be three circumstances which may either of them produce impaction of a tooth in the substance of the maxillary bones: the tooth may be originally developed too deep in the body of the jaw, and thus, though it grow in a right direction and in a right position as regards the series, it will never reach the alveolar margin; or while it may be sufficiently superficial, it takes an oblique direction of growth, so that it lies covered more or less in the axis of the bone; or again, the position of the tooth and its line of growth may be originally normal, but from an arrest of the development of the fang it may fail to reach the alveolar edge, and so remain permanently impacted in the maxilla.* This may occur to any tooth, and has been recorded as affecting most of the permanent set; but it is more common with some than with others: it has been more often met with as regards the upper permanent canines than any other teeth. In cases where a successional tooth is impacted in the jaw, its temporary predecessor is usually retained considerably after the natural period of shedding. When a tooth is thus situated, its fang is enclosed in a bony socket lined by periosteum, as in ordinary circumstances, while the crown of the tooth is free in a little bony locus lined by that which was the so-called "enamel-pulp." This structure is clothed with a sort of epithelium, which is apt to assume the function of secreting fluid. After the enamel is completely formed, the soft membrane which rests upon the surface of the crown of the tooth frequently separates from it, the interval being occupied by a sort of serum. This is generally the result of some irritation or difficulty in tooth-cutting; and where the irritation runs on to acute inflammation, as in some cases of tedious eruption of wisdom-teeth, the secretion may become purulent. In the deep-seated cases of impaction of teeth, the action is, I believe, always slow, and the secretion almost always serous.

The recorded instances of this condition are so few, that it is

* "On the Impaction of permanent Teeth in the substance of the Maxillary Bones," by S. J. A. Salter, in *Guy's Hosp. Rep.* vol. v. 3d series.

scarcely possible to generalise upon them : it may, however, be said that they have usually happened in young persons, at least have commenced in adolescence, shortly after, though sometimes before, the maturation of the impacted tooth. In the cases narrated, the upper grinders have been more frequently involved than other teeth, the serous cysts dilating into the maxillary sinus : but incisors, canines, premolars, and molars, have all been associated with this condition.

M. Jourdain* describes three cases of dentigerous cysts. The first case he records was that of a girl, 17 years old, in whom the right upper first and second permanent molars were inverted, and a large serous cyst had expanded around them into the antrum, with great dilatation of the body of the bone, distortion of the side of the face, and closure of the nostril : it had existed "some months." In a second example, a man about 60 years of age suffered from a tumour the size of a pigeon's egg in his upper jaw, for many months, closing the nostril of that side ; it was caused by the expansion of a cyst around the second premolar, which was impacted deep in the substance of the bone. The third instance occurred in a girl, 13 years of age, from a monstrous permanent lateral incisor (side not stated) being imbedded in the intermaxillary bone, above and behind the root of the central incisor ; "there was a considerable tumour, which occupied anteriorly the whole region of the maxillary hollow." It had existed for a year.

Dupuytren† describes a specimen shown to him by M. Loir, in which a cyst was developed in the left superior maxilla : this cyst involved, and was dependent upon, the presence of the canine tooth in a reversed position.

The author was informed of a case of this disease by his late colleague, Mr. Bransby Cooper, in which great swelling occurred in the substance of the superior maxilla of a young man, in whose mouth the first and second permanent molar teeth had never made their appearance. A free opening was cut into the expansion, when the wanting teeth were found inverted in the axis of a serous cyst, expanding into the antrum. No account of this case appears in Mr. B. Cooper's Lectures on Surgery, but the author took memoranda of its particulars when communicated to him.

Mr. Wormald operated on a boy, about 14 years of age, some time since, at St. Bartholomew's Hospital, in whom a serous cyst

* *Traité des Maladies de la Bouche*, par M. Jourdain, tom. i. pp. 119-125, Paris, 1778.

† *Leçons Orales de Clinique Chirurg.*, Dupuytren, tom. iii. p. 8, Paris, 1833.

had expanded about the second bicuspid tooth of the lower jaw; the cyst was the size of a large chestnut, and was in the axis of the bone: the fang of the tooth was not fully developed. The interior of the cyst was lined with a thick vascular membrane, and it contained a glairy fluid. Mr. Wormald has favoured the author with these particulars.

F. E. Glaswald published a very learned inaugural discourse on this malady, at the University of Greifswald, in 1844, containing a complete résumé of the literature of the subject.* The text upon which this essay was elaborated was a case that had been under the care and treatment of Prof. Baum. In this instance a cyst had dilated each antrum to an enormous extent, and with hideous disfigurement of feature. The patient was a woman, 38 years of age, and the disease was said to have been in progressive existence for thirty years. From a cyst in the right antrum a canine tooth was removed, and from the left a molar. The fluid in the cysts was purulent.

Two instances of this condition have occurred in my own practice. In one a serous cyst expanded the left angle of the lower jaw in a young man 22 years of age, resulting from the impaction of the dens sapientiæ. The cyst was very large, and had been twice opened to allow the escape of the serum, which had in each instance rapidly re-collected. I extracted the second molar, which was loose: this ruptured the cyst, liberated the serum, and freed the impacted tooth; its crown appeared in the alveolus of the second molar, whose posterior fang was greatly absorbed by the progress of the cyst. The case was entirely cured by this means alone; and the dens sapientiæ gradually rose into the mouth in an oblique position. The other example is very interesting in a diagnostic point of view. A girl, 18 years of age, had an elastic fluid-containing tumour in the substance of the incisive bone, extending up to the base of the nose on the left side. She had been seen by two or three Surgeons; but the nature of the malady was not ascertained. She had the normal *number* of teeth in the jaw, though the *character* of one of them was abnormal for her age. When the patient was sent to me for my opinion, I perceived that the left central incisor was a *temporary* tooth; and this circumstance was a key to a correct diagnosis of the case. The left temporary central incisor occupied a position which its permanent successor should

* *De Tumore quodam utriusque Antri Highmori perversa dentium formatione exorto*, auctor Franciscus Edwardus Glaswald; Gryphiae, 1844.

have held: the absence of the tooth, under such circumstances, suggested the almost inevitable position which it must occupy above and behind its temporary predecessor, that is, in the axis of the serous cyst. The temporary tooth was removed, and the cyst explored, to discover the succeeding tooth. The permanent central incisor was found deep in the bone, in an upright and natural direction; its crown bare within the cyst; but upon its removal it was observed that the fang was aborted, and had only grown to one-fifth its natural length. This circumstance it was which had prevented its extruding its temporary predecessor, and establishing itself in its normal position. The retention of the tooth in its epithelioid sac furnished the anatomical grounds from which, under favouring circumstances of irritation, the serous secretion arose, and the bone-expansion followed.

Pathological specimens of uncommon diseases, and those too not killing or shortening life, must necessarily be very rare. This applies to specimens illustrative of the disease we are considering. One is in the possession of Mr. Samuel Cartwright, jun., and is valuable and instructive in many points.* The preparation consists of a right superior maxilla—an adult bone: the teeth that remain, and the alveoli from which others have been extracted, show that the normal number of permanent teeth had developed in their natural position. The turbinated bones are gone, and the antrum maxillare is open. In the antrum, starting from its base, but not attached to its lateral walls any where, is an exceedingly thin, delicate capsule of bone, about the size of a chestnut, white, with a granulated surface. The bony capsule contains nothing but one small *supernumerary* tooth, which is *loose* and *free* in the cavity. There are three important points in this specimen bearing on the anatomy and history of these cases:—the tooth is a *supernumerary* one; it is free and wholly detached in the cavity of the cyst; and further, the expansion is not that of the antral wall itself, with the tooth's crown uncovered within it, but a distention of that which was the bony locus of the contained tooth, which, by its further dilatation, would have expanded the antral wall, and probably have been confounded with it.

This latter circumstance appears to me to be of much anatomical interest in reference to those serous expansions of the antrum which are associated with inverted teeth. These have hitherto been de-

* Through the kindness of my friend Mr. Cartwright, I have been allowed to figure this specimen. See *Guy's Hosp. Rep.* 3d ser. vol. v. p. 328.

scribed as cysts of the antrum itself: but I cannot conceive that a tooth being “cut” through the mucous membrane of the antrum should produce such a result. The appearance of the crown of an inverted tooth in the nostril neither causes irritation nor increased secretion—at least no such consequence followed the three examples I have seen; and it seems to me to be far more probable that these cases have commenced as cysts within the bone at the base of the maxillary sinus, expanding into it, and ultimately filling its whole cavity and dilating its walls.

Two specimens in the Museum at St. Bartholomew’s Hospital throw some further light on the pathology of this condition. One preparation (numbered I. 119) exhibits a thin bony cyst, the size of a small Tangerine orange, with a thick membranous lining: it contained an inferior permanent canine tooth, *loosely attached* to its walls. It was removed from the lower jaw in the region of the contained tooth. The other preparation (I. 119a) is the superior maxilla of a young sheep, in which the central incisor is attached to the side of a large cyst; the *fang* of the tooth being *almost wholly destitute of bony covering*. This denudation of the fang does not appear to exist in the early stages of these cases, but seems to be brought about by great expansion of the cyst, and the progressive absorption of bone which accompanies it.

In one instance only am I aware of a dentigerous cyst being associated with a *temporary* tooth. It occurred in the practice of my friend Mr. Alexander Edwards of Edinburgh. The patient was a young man, in whose upper jaw, just below the orbit, a tumour had developed: the tumour consisted of exostosis from the maxilla, combined with a bony cyst, containing a tooth, which was pronounced by Prof. Goodsir to be a temporary molar: from a portion of the tooth, which I afterwards saw, it appeared to be the second, the larger of the two.

I have thought that this brief summary of the principal recognised cases of dentigerous cysts may be of value, as there is not in the literature of this country any allusion to more than a few isolated ones.

The *symptoms* of a dentigerous cyst are almost wholly local, consisting of a general expansion of the jaw-bone at some particular spot; accompanied by a corresponding disfigurement of the neighbouring features, and a sense of weight and tension at the affected part. Where the impacted tooth has produced pressure upon a neighbour, the symptoms of pain and local distress have been more considerable, and have given rise to some constitutional irritation.

Upon manipulation the fingers readily perceive that the tumour is a central expansion of bone, and that it contains fluid; the bony walls yield to pressure, and then return to shape with that peculiar kind of crepitation which Jourdain characteristically calls *craquement*, like the doubling of stiff parchment; and the bone is usually sufficiently thin at some part to allow the production of fluctuation under the pressure of alternate fingers.

One of the most usual symptoms, and which is also an important *diagnostic sign*, is the absence from the mouth of some tooth or teeth which should have appeared, and have never been extracted. The presence of a fluid-containing tumour within the substance of a maxillary bone at the region of a tooth which is missing, and known always to have been wanting, would be well-nigh conclusive as to its being a dentigerous cyst, though the presence (or the past-known presence) of every mature tooth would not necessarily prove the reverse; for the dental element in the case may be a temporary or a supernumerary tooth. However, an impacted temporary tooth is a very great rarity, and one producing a serous cyst still more uncommon: the same may be said of a supernumerary tooth. The diagnosis may be further advanced by exploring the cyst either by means of a grooved needle or trocar, when a serous discharge will still further support the idea of a tooth-cyst; and if the cavity be laid open, a probe will scarcely fail to discover the hard unyielding substance of the crown of the tooth.

The *treatment* of these cases is obvious, and usually quite efficacious. It consists in evacuating the contents of the cyst, extracting the tooth or teeth embedded in it, and where the expansion is large, in removing some of the dilated bone. The operations should be performed as early as possible, so as to prevent the necessity of cutting away much bone, and the prolonged and tedious absorption which would follow before the face or jaw assumes its natural form. All cutting should, if possible, be done within the mouth. Generally a portion of the wall of the cyst may be removed readily enough with a scalpel; but where the involved tooth is reversed, the expansion is likely to be away from the alveolar border. In that case bone-nippers, the extraction of contiguous teeth, or even the saw, may be necessary. This has been especially the case where inverted teeth have caused cysts in the antrum. The tooth is likely to be found at the base of the cyst, furthest, *i. e.*, from its thinnest expansion. Some difficulty may be found in getting hold of and removing the embedded tooth; but various long-bladed extracting

forceps may be readily devised to suit any case, if a difficulty should arise.

In some cases, from a persistence of the serous secretion, it has been found necessary to inject the cyst with astringent and stimulating injections.

The issue of these cases is, I believe, always satisfactory. I am not aware that it ever led to necrosis or other bone-disease. In one instance which I saw, a fibrous tumour grew from the cicatrix of the wound some months after the first operation: this was removed, and did not recur.

VI. Alveolar and maxillary necrosis from (a) *Phosphorus fumes*; (b) *Eruptive fevers*.

The relation of the phosphorus poison to the disease in question, and its method of introduction, or rather application, are among the most distinctly proved of any of the circumstances connected with the history of disease. Probably there is nothing in pathological history where clear data, and simple induction from those data, have more lucidly illustrated the questions of cause and effect. To bring about the "phosphorus disease," phosphorus in some form must be applied to the periosteum, or, what is equivalent to the periosteum, to some raw vascular surface in immediate connexion with the nutrition of bone; and the application must be prolonged, must be under particular circumstances of temperature, and probably of oxidisation. These conditions alone occur in those manufactories where phosphorus is employed in the making of lucifer-matches; and there alone (or scarcely with exception) it is that this disease is manifested. But the circumstances which connect the outward cause with the disease that follows it, is a predisposition in the individual, consisting of some exposure of the periosteum, or what is tantamount to such exposure. The only manner in which this occurs, at least in which phosphorus appears to be effective in causing bone-necrosis, is where caries of a tooth exposes the pulp to the poison-influence, the bone-necrosis being that of the jaw. It is the poisoning of the tooth-pulp that is the essence of the disease; the severe combinations of bone-affection, which give all the importance to the malady, are but contingent and secondary consequences. It is this fact in the essential nature of the disease that links it (as I think) to that other form of maxillary necrosis which occurs in children after attacks of the eruptive fevers; only that, whereas in the phosphorus disease the poison is applied to the tooth from an extraneous source—from without, in the jaw-necrosis

of eruptive fevers the poison is generated within, and alights upon the teeth and tooth-pulps, by virtue of their being dermal organs, members of the tegumentary system, upon which system generally the eruptive fever-poisons spend their chief destructive force.

Phosphorus disease. The necrosis and exfoliation of portions of the jaw-bones, dependent on phosphorus fumes as its cause, is so entirely associated with the manufacture of lucifer-matches, that not only are all the particulars we know of the malady derived from the victims of that occupation, but the disease itself was not known to have an existence until some years after these light-producing agents had taken the place of the old tinder-box, and by the large demand for them had given rise to extensive laboratories for their production.

The earliest published account of the disease which we have, is by Lorinser,* of the *Besirks Krankenhaus Wieden*; and the first case which fell under his notice occurred in 1839, about eleven years after the opening of lucifer-match manufactories in Vienna. In this country, as far as I am aware, the malady was first recorded by Dr. Wilks, in *Surgical Reports of Guy's Hospital*, from April 1846 to March 1847, where he remarks, "Of the other diseases of the lower jaw, one occurred in a lucifer-match maker, with suppuration and exfoliation of bone."† It is, however, to the continental Surgeons, and those principally of Germany, that we are indebted for the complete and early account of this malady, from which all subsequent notices have been mainly derived. Besides the original memoir by Lorinser, before referred to, important contributions have been added by Strohl,‡ Heyfelder,§ Roussel and Gendrin,|| Sédillot,¶

* I have had no opportunity of consulting Lorinser's original writings: they are referred to by Geist as—"in den medicinischen Jahrbüchern des K. K. Oesterreichischen Staates, Jahrgang 1845, Märzheft."

† *Guy's Hospital Reports*, 2d series, vol. xii. p. 163, Lond. 1847. This case occurred in the hospital practice of the late Mr. Aston Key, who, as Dr. Wilks informs the author, was already aware, from his own observation, of the essential nature of the disease and its relation to its peculiar cause.

‡ *Gazette Médicale de Strasbourg*, cinquième année, no. 11, 20 novembre 1845.

§ *Vierteljahrsschrift von Roser und Wunderlich*, Jahrgang 1845, Heft 3; and *Medicinische Zeitung des Vereins für Heilkunde in Preussen*, Jahrgang 1845, no. 45.

|| *Recherches sur les Maladies des Ouvriers employés à la fabrication des Aluminettes chimiques, &c.*, Mémoire présenté à l'Académie des Sciences, le 16 février 1846.

¶ *Comptes Rendus des séances de l'Académie Royale des Sciences de Paris*, mars 1846.

and, above all, by Von Bibra and Geist,* whose exhaustive treatise, their joint production, has given the clearest elucidation of this new disease.

That the *cause* of the maxillary necrosis and exfoliation occurring among the artisans employed in making lucifer-matches is the fumes of the phosphorus, need not be discussed; the question has been already settled; and the reader is referred to the writings of the authors above named, especially the last cited, for the consideration of this point. The only question on this head which deserved serious inquiry arose from the fact, that the phosphorus employed was often impure, and contained a notable quantity of arsenic; and this Martius and Dupasquier considered might be the essential cause of the malady: but this supposition was not found to hold good under more critical and extended examination.† It is only

* *Die Krankheiten der Arbeiter in den Phosphorzündholzfabriken, &c.*, Erlangen, 1847; also *Die Regeneration des Unterkiefers nach totaler Necrose durch Phosphordämpfe*, von L. Geist, Erlangen, 1852. An admirable digest of this subject has been published, in the shape of a review of Von Bibra and Geist's work, in the *British and Foreign Medico-Chirurgical Review* for April 1848.

† The actual agent in producing the phosphorus disease is doubtless oxidised phosphorus, probably in the form of phosphorous or phosphoric acid, dissolved in the saliva. The precise nature of the fumes is not exactly known; they consist principally of phosphorous acid (H_3PO_3), which by mixture with air becomes phosphoric acid (H_3PO_4); and probably minute quantities of phosphorus-vapour (P), phosphuretted hydrogen (H_3P), and hypophosphorous acid (H_3PO_2), are also present. Any vapour of phosphorus and hypophosphorous acid would be speedily converted by the air into phosphorous and phosphoric acids. Phosphuretted hydrogen would be more slowly oxidised into the same products. At any rate, nearly if not quite the whole of the fumes when inhaled by the work-people would be in a state of some acid of phosphorus capable of being fixed and neutralised by an alkali. Such being the case, it is greatly to be regretted that efficient sanitary measures are not adopted to prevent the disease, which surely might be done. The recommendations of Geist and Roussel amount simply to cleanliness and ventilation, and are not sufficient. I would suggest, that in all lucifer-match manufactories there should be a periodic and rigid scrutiny of the mouths of all the work-people employed. Those having faulty teeth should be excluded from the rooms (the *dipping* and *drying* rooms) where the obnoxious fumes are being developed. All carious teeth should be extracted or plugged. What is more important,—a very simple and effectual respirator for the mouth might be worn by the employés; it would be unnecessary over the nostrils. It should be constructed on the ordinary plan of respirators, but its centre consisting of a porous diaphragm, such as sponge or some woven fabric, linen or cotton, which should be daily dipped in a solution of one of the fixed alkalis or their carbonates.

when the cause has been long in operation, and under circumstances of great intensity, that the disease is developed; it is confined almost entirely to those who are employed in the process of *dipping* the matches into the fused and reeking phosphorous compound, and those who dry them in the same apartment. Moreover, a long exposure to the influence is necessary for the production of the disease. Lucifer-manufactories had existed eleven years in Vienna, when in 1839 Lorinser observed the first case which attracted attention; and the shortest known period in which the malady has developed itself was in an instance which occurred in Paris, and is recorded by Gendrin, in which the patient had been employed in the occupation two years before the first symptoms appeared. Another circumstance of curious import, though not invalidating the generally-received doctrine of local poisoning, is, that the sufferer may have been removed from the baneful influence for a considerable period, and nevertheless be subsequently attacked by the disease. Strohl gives an instance of a girl who had worked as a *dipper* at a lucifer-match manufactory for five years; she left that employment, and adopted a totally different and healthy occupation, when, after three months, she was for the first time attacked with unmistakable symptoms of the phosphorus disease, ending, after fifteen months, in exfoliation of portions of the superior maxilla. It is very seldom that others than those employed in making lucifer-matches suffer from this malady; but that this may happen should not be lost sight of. Pluskal* mentions an example of a little girl, 7 years of age, who was in the constant habit of playing with matches, standing before a wall and discharging them in the dark for amusement, so that her face was bathed in their fumes; in time she was attacked with necrosis and exfoliation of small portions of the front of the lower jaw, with the ordinary attendant symptoms. And Simon narrates a case in which the disease appears to have been brought on by a person chewing pieces of ginger, which he

This would arrest nearly, if not quite, all the acid fumes of the phosphorus. Or the respirator devised by Mr. Graham for persons exposed to carbonic acid vapour would probably be as efficacious. It consists of the mixture in equal bulk of fresh-slacked lime and sulphate of soda, through a cushion of which it is easy to breathe. The wearing of some such respirator should be compulsory with the dippers and dryers. Again, the acid vapour might be neutralised and rendered innocuous by keeping the atmosphere of the apartment ammonuretted. I believe, if these precautions were adopted, the disease would seldom, if ever, manifest itself.

* *Oesterreichische Medicinische Wochenschrift*, no. 30, Wien, den 25 Juli 1846.

kept in his pocket with some lucifer-matches. The influence of the phosphorous fumes upon the jaw is undoubtedly local. Lorinser, who has the merit of discovering this disease, held a different opinion; but Roussel, Geist, and indeed subsequent writers generally, have adopted the opinion, which all the evidence upon this point seems clearly to establish.* I have not space here to enter upon the argument of the question; I may, however, mention one telling fact; it is, the necessity of dental caries in the individual before the disease can be produced. It has never been known to occur, excepting where the sufferer has had carious teeth; and many persons have worked in the manufactories for a long series of years with perfect impunity, who, upon the supervention of dental caries, have been attacked with the malady. Dental caries, by opening the central chamber of the tooth and exposing the pulp, seems to offer a tolerably direct channel for the poison to be communicated to the subjacent periosteum, and this, no doubt, is why tooth-destruction is a necessary preëxisting condition. What the precise nature of the action of phosphorus-oxide thus absorbed may be upon the bone, is a matter of speculation; but the particular nature of the poison, entering as it does so largely into the composition of the skeleton, is a suggestive circumstance; perhaps, if accumulated by the periosteum, it may generate on the bone's surface a condition of chemical *superphosphate*, inconsistent with osteal vitality.

The *symptoms* of phosphorus-necrosis do not differ essentially from other forms of necrosis in the same parts: they are, however, not infrequently accompanied by bronchial and pulmonary irritation from inhalation of the fumes: this has been especially pointed out by Sédillot, Gendrin, and Dupasquier.† And one of the patients whom I have seen, affected with this malady, has detailed to me symptoms of *spasmodic asthma* which occasionally supervened when he was employed for many continuous hours "*dipping*" while suffering from a common "cold" in winter weather. Barring this occasional manifestation of pulmonary irritation, the general health of these work-people is remarkably good.

The symptoms of the jaw-disease usually commence with what is supposed to be toothache, the pain being at first pretty much localised to some one tooth that is carious, and which is probably the channel by which the poison is introduced. The advance of

* The arguments bearing upon this question, and the conclusive inference to which they lead, are stated with cogent force in an admirable clinical lecture on this subject by Mr. Simon, in the *Lancet* for 1850, p. 41.

† *Gaz. Méd. de Paris*, 1846, no. 49.

the disease is generally slow at first, and, as it were, undecided,—indeed, indefinitely chronic: the pain is inconstant, and not early attended with more serious symptoms: presently, however, it becomes more severe and erratic, extending vaguely about the side of the head and down towards the shoulder, and with this severer pain swelling and extreme tenderness occur; the integument near the affected region becomes red, tense, and distended, while the teeth feel elongated and intensely painful when brought in contact with their fellows of the opposite jaw, and they become very loose. The gums are swollen and livid, and this condition extends to the mucous membrane of the cheek. All these symptoms increase till suppuration is established, and with them, more or less, symptomatic fever is developed in proportion to the severity and extent of the disease: the patient has rigors and pyrexia, and is often thoroughly ill. The point at which the pus finds its discharge varies a good deal: the soft parts first become very boggy, especially the gums, and matter often escapes early around the necks of the loose dead teeth; when pointing externally, its approach is accompanied by intense glistening erysipelas-like redness of the integument. The discharge of the pus is attended with great mitigation of the patient's suffering. The pus itself is often sanious at first, and very fetid, having the odour characteristic of the presence of necrosed bone. The orifice of discharge frequently leads to long burrowing sinuses, especially where the lower jaw is affected; and through these the dead bone may be detected by a probe. The swelling which attends the disease is often very great, particularly when the lower jaw is necrosed: it is diffuse and wide-spread, encasing the external and under surface of the bone in a prodigious, dense, plastic exudation. In very severe cases, previous to the discharge of pus, while the inflammatory symptoms are at their extreme height, the whole head, except the summit of the scalp, is involved,—the eyes are closed; the nose, and even the forehead, swollen; the cheeks, lips, neck, and throat, are one continuous area of florid intumescence. It is a curious circumstance that in the lower jaw the necrosis is attended with a very large and complete development of ossifying callus, whereas none is formed when the upper jaw is affected. The large plastic exudation which surrounds the base of the lower jaw becomes converted into a mass of supplemental bone, supporting the sequestrum, which is, for the most part, naked and bare within and behind, and connecting sound portions of bone at its extremities when the whole of the maxillary arch is not involved.

Geist assumes that the particular region occupied by the osteophytic incrustation about the lower jaw is the result of gravitation—an idea altogether too mechanical: it is rather to be looked upon as a physiological manifestation, and one element in that marvellous exhibition of the *vis medicatrix nature* which this repair of the lower jaw displays: the supplemental bone thus placed forms the best support for the sequestrum, and the least interferes with the functions of the mouth; while the absence of an ossifying callus at the upper and inner region of the maxillary arch offers the readiest escape of the dead bone through the thin mucous membrane which there alone covers it, and this without damaging the integument of the face.

As the bone becomes laid bare by the ulceration of the soft parts, it is observed bathed in ichorous pus, ragged and irregular in its surface, and of a dirty blackish gray colour: this latter condition is said to be invariable, as though characteristic; but it is not so, for although very general, I have seen specimens white and clean, and with the compact external layer of bone intact.

To return to the symptoms of the disease. When the extent of necrosis is very great, the constitutional disturbance is correspondingly severe; and in the early stages of the malady the patient may have intense fever, with delirium and agonising local suffering, the more distressing from the region which the affection occupies—interfering with or altogether suspending the action of the mouth, and, by the secretion of foul and fetid pus, producing nausea, ructus, vomiting. The looseness and projection of the dead teeth is another source of annoyance and distress: as the sequestra containing them emerge from the surrounding parts, their elongation and angularity much irritate the gums and cheek in contact with them. In the severest cases, general sphacelus of the soft parts about the jaw, with œdema of the face and neck, may supervene, accompanied, or not, by erysipelas; and death may then close a scene of terrible suffering. In other instances with a fatal issue, life is drawn out through many months of tedious illness, varied by different degrees of local irritation; till at length the patient, with vital endurance inadequate to the requirements of the disease, sinks, tabid and exhausted, under continuous hectic, and not infrequently with tubercular complications.

When the malady progresses to a favourable issue, which it does in the majority of cases, the dead bone gradually loosens and becomes detached; and this is generally anticipated by the falling out of some of the necrosed teeth. In the upper jaw the sequestra

are usually more broken up and smaller than in the lower, and they are shed easier, not being held in and detained by ossifying callus, which is always wanting in the upper jaw. In the lower jaw the sequestra are usually more extensive, often including large portions of the body of the bone, not infrequently the ascending rami, and sometimes the coronoid processes, and even the articular condyles. The shedding of these sequestra is often hindered by the large surrounding ossifying callus which always forms when the lower jaw is the subject of this disease.

I may here mention that some stress has been laid upon the circumstance that the lower jaw has been more frequently observed to be affected than the upper: but the difference is slight, and is probably only an accidental coincidence. The learned reviewer* of Geist and Von Bibra's work has given much detail bearing on this point; he enumerates twenty-five examples in which the lower jaw was affected, to twenty-one in which it was confined to the upper jaw. In five cases which I have seen, the lower jaw was diseased in four and the upper in one; whereas four, which occurred in the practice of a surgical friend, were confined to the upper jaw. In seventeen instances of which I have obtained particulars or seen specimens, nine were connected with the superior, and eight with the inferior maxilla. The disease is therefore pretty evenly balanced between the two jaws.

The results of phosphorus-necrosis, in cases which get well, are very various. As regards general health, the patient usually recovers with an elastic convalescence after the dead bone has been removed; but the physical condition of his maxillary apparatus is often terribly mutilated. When the front part of the upper jaw is affected, it is an absolute and unrepaired loss, miserably disfiguring the patient, altering the physiognomy most painfully; when it affects more hidden parts of the jaw, the loss is not less complete, though less conspicuous.

If the affection is confined to the inferior maxilla, the removal of the sequestrum leaves a supplemental bony representative, which, for a time, more than makes up for the loss of dead bone, and for a long subsequent period efficiently performs the office of edentulous mastication, and supplies the wants of personal comeliness.

In some instances the whole of the lower jaw has been lost, excepting the articular condyles; and these, apparently connected with the new bone, have established the joint requirements of the supple-

* *British and Foreign Med.-Chir. Review*, before cited.

mental jaw; but in other instances (cases in St. Bartholomew's Hospital, and those mentioned in Geist's later work*) even the articular ends have been shed with the rest of the sequestrum; still there has been joint movement, doubtless from a ligamentous attachment of the new bone.

Though it has not been stated in books, this repair of the lower jaw is but temporary; for after a time—often a considerable time—the new bone diminishes, by absorption, to a mere narrow arch, and ultimately there is scarcely enough bone to keep out the lower lip, and the chin is utterly lost. I have had an opportunity of examining this state of parts after the lower jaw had been removed ten years. How far this loss, by absorption of supplemental bone, may be prevented by supplying it with a function, through the means of artificial teeth, is a question of theoretical interest and of practical importance.

The *treatment* of phosphorus-necrosis of the maxillæ divides itself into that which is common to all bone-necrosis, and that which specially applies to the particular local affection in question. Upon the latter head alone I would remark.

In the early stages of the disease, when as yet it is not established, but its supervention feared, it would be of the last importance to remove the patient from the cause of the malady; pure air should be sought, abundant cleanliness, with urinary and alvine excretants, resorted to, and all suspicious teeth extracted. When, however, the local symptoms—extreme pain, swelling, and indurated infiltration of the soft parts—develop themselves, and the disease has already passed its premonitory stage, it will be advisable to have recourse to more active measures. Upon this point I cannot do better than quote Mr. Simon's remarks in his admirable Clinical Lecture, already referred to, and in the justice and propriety of which I entirely concur: "So soon as the second or inflammatory stage of the disease has thoroughly set in, the bone seems in every case to be irrevocably doomed to necrosis; and I would therefore recommend you, in the event of your being called to a case at the transition-period between the two stages, when hypertrophy is passing into inflammation, to adopt without hesitation the most active measures for relief of the periosteum and bone. Leeches and general antiphlogistic treatment *may* do good; but the consideration of the pathology of this disease, together with the analogy of other periosteal affections, leads me to believe that the only real chance of doing good would

* *Die Regeneration des Unterkiefers nach totaler Necrose*, v. L. Geist, 1852.

lie in still more energetic measures ; and I would recommend you in any such instance to make, with your scalpel, free vertical incisions through the gum wherever tenderness and swelling exist ; extending your line of cut upwards in the upper jaw, or downwards in the lower, as far as the structure of the parts will allow, bringing your incisions as near together as circumstances may require, and in every point carrying them clearly down to the bone, so as to afford the utmost relief and relaxation to the overloaded and tense periosteum. I believe that this method of procedure would be the nearest approach to an effective one for checking the inflammatory stage of the disease before it has reached an intensity which must inevitably destroy the jaw."

When the stage of threatening has past, the extent of the inflammatory mischief appears to assert itself at once,—the whole of that portion of bone which is subsequently the sequestrum appears to be stricken from the first. Prevention is at an end, and palliation rather than cure is indicated as the Surgeon's mission. When pus has formed, it should be early conducted to the surface ; and by judicious interference external scars may often be prevented by means of well-directed punctures within the mouth. The whole of the teeth implanted in the dead bone become loose, and apparently elongated ; their doom is already sealed, and they should be extracted without delay, as they cause much irritation to the tongue and cheeks.

When the discharge has established itself, and the fetid pus is pouring from the sinuses that communicate with the dead bone, abundant rinsing of the mouth should be had recourse to, not only in the form of mere washes of water to remove the filthy secretions, but astringent and deodorising lotions, such as decoction of cinchona and solution of alum, solution of chloride of lime, and, still better, solution of permanganate of potass. As has been pointed out by Mr. Simon, the unhappy patients are sometimes so disabled as to be incapable of gargling out their mouths, and then little pieces of sponge may be used by them to wipe away the stinking discharges.

As regards the sequestra, little can be done. Sharp projecting pieces of bone may be cut off by nippers ; but the bulk of the dead bone must take its own time to be shed—often a very long time. It is a period of miserable suffering to the patient, and terrible constitutional exhaustion ; but it cannot be shortened, or its results anticipated. At the present time (March 1862), there is in the London Hospital, under the care of Mr. Adams, a patient whom I have recently examined, who has been suffering from the disease, affecting the entire inferior maxilla ; it has been going on two

years and a half; the latter four-fifths of the time with the lower jaw, except probably the articular ends, dead and lying in the mouth, bare and ghastly, bathed in ichorous pus within its, at present, huge supplemental successor.*

The sequestra of the superior maxilla are apt to be more detached than those of the inferior—divisible and smaller, and they can be brought away piecemeal; moreover, as the upper jaw is an attached, and not, like the lower, a floating bone (with muscles ready to displace its parts when the integrity of its arch is broken), its dead portions can be removed without jeopardising the relations of the rest of the bone. Therefore a little and early surgical interference may be employed without injury, and parts brought away which, if belonging to the lower jaw, had better not be interfered with. In the lower jaw the disease is usually so much more comprehensive, and its resultant sequestrum so solid, that patient watching and palliative treatment are all that can be adopted generally till the very close of the case. Earlier interference might disturb the relations of the supplemental bone (the *natural splint*) and the portions of jaw still living, and, by allowing the strong antagonistic action of the muscles attached to the two halves of the latter to act separately, lead to the permanent displacement of the elements of the maxillary arch. The articular ends of the bone often, indeed in the majority of cases, though not always, escape the necrosis, when the whole of the rest of the bone may be destroyed; and this circumstance suggests an element of treatment which may much shorten the patient's suffering. When the necrosis has evidently passed up to the neck of the condyles, the bone may be removed by sawing or nipping across the neck as high up as possible (on either side, if both sides are affected), and then dividing the body of the jaw at its symphysis, the two halves of the bone may

* Since the above was written the necrosed jaw has been removed. The operation and its sequence were both unusual. The patient was placed in a kneeling posture, with the chin on a table, and, the mouth being open, the symphysis of the jaw was split down by a chisel and mallet. The right half of the bone was then seized by large strong forceps, and wrenched from the mouth with great force. After a week the same course was adopted with the left half; but this required still greater traction. The entire bone was thus brought away, including the condyles. Ten days after the first operation the patient was seized with secondary hæmorrhage, profuse and arterial, on the *right* side from the wound, where the first portion of jaw was removed. This necessitated ligature of the right common carotid artery. The latter operation was performed by Mr. Maunder; and the patient recovered perfectly. See *Med. Times and Gazette*, July 5, 1862.

be withdrawn, one by one, without any external wound. Should the condyles be necrosed and follow, no harm will have been done by the previous operation, and the patient's suffering will have been much diminished and curtailed. The division of the bone may be accomplished by a Hey's saw, or some modification of it, improvised to suit the particular position of the required line of section. Various curved bone-nippers may also be devised to accomplish the same objects. The extreme and firm closure of the mouth sometimes renders this operation very difficult.

I need not dwell upon the general treatment of these cases, as far as they are in common with those of bone-necrosis generally. The particular region affected, however, involving and disabling, as it does, the masticatory function, entails some modifications. In the long tedium of their course every effort should be made to supply, by suitable food, the deficiencies which suspended mastication entails,—mashed meat, eggs, cod-liver oil, and such sustainants, should be abundantly employed; and iron salts, in moderate proportion, should, if bearable by the patient, be almost a matter of daily diet rather than an occasional medicine.

There is one point which I would allude to,—more a matter of pathological curiosity than having any other bearing; it is, the enormous amount of *pus* which these patients daily swallow and (apparently) digest. It must be many ounces, and this without any obvious detriment to health; the patient's condition being no worse than may be accounted for by the force of the local symptoms.

Exanthematous jaw-necrosis. I believe that the necrosis and exfoliation of the alveolar processes and portions of the jaws in children, consequent upon the eruptive fevers, is essentially the same as the maxillary necrosis in the victims of phosphorus fumes, and that it is the result of the local application of a specific poison to the vascular parts of teeth. There is this difference, however, that in the cases we are now considering, the poison is generated within the individual, but with affinities for certain structures and tendencies to action upon certain organs which give its morbid consequences an equally local character. Whatever opinions may be entertained as to the homological relations of the several tissues of the teeth to those of the general integument, there can be no question as to their being members of the dermal system; and as such we should, *à priori*, expect that they would share the consequences which attend those particular diseases which spend their chief force on the skin. There is one circumstance, however, that modifies such an anticipation: it is the low state of vitality of the

teeth, and the extremely slight nutritional changes which occur in them *when once they are formed*, and which must consequently remove them to a great extent from those transient though potent influences which would destroy or morbidly affect vascular or rapid-growing tissues. But such a qualification does not apply to the conditions of the teeth during their development. From the time of birth till the eighth or ninth year, the jaw-bones are the seat of intense developmental nutrition in the formation of the teeth, and are among the most vascular parts of the body: about the middle of the period named, five years of age, the maxillæ contain no less than forty-eight developed teeth and developing tooth-germs. It is about this time that the poison of the exanthematous fevers appears to exert its most deadly influence on the dental system.

The form of necrosis affecting the alveolar edges of the maxillæ, and accompanied by the shedding of the teeth, which we are now considering, was, I believe, first recognised by myself* as one of the sequelæ of the exanthemata, and dependent necessarily on their previous occurrence. Many isolated cases of the affection have been described, and our museums contain specimens of the sequestra; but the supposed relation of cause and effect had not, so far as I know, been expressed before.

This affection is by no means common, considering the almost universal occurrence of the eruptive fevers. The very large population tributary to Guy's Hospital has only furnished me with twenty-three or twenty-four cases during the last nine years; and I have reason to think that even in this I have been disproportionately favoured.

The cases are all singularly alike. A little child has just recovered from one of the eruptive fevers, most probably scarlatina; the case has been in no way unusual as to its severity or its course: within six weeks or two months of the passing off of the acute symptoms, tenderness of the mouth is complained of, and the mother notices fœtor of the breath. Upon inspecting the mouth, the gum is seen to be peeling from the edge of the jaw around the neck or necks of some temporary tooth or teeth; pus is discharging, and more or less dead bone is exposed. The denudation of the bone progresses rather quickly in depth, but usually not after the first in lateral extent; the temporary teeth at the affected part become loose, and often fall out. There is no swelling; and no ossifying

* "On the Shedding of the Teeth, and Exfoliation of the Alveolar Processes, consequent upon the Eruptive Fevers," by S. J. A. Salter, *Guy's Hospital Reports*, 3d series, vol. iv. Several specimens of sequestra from these cases have been figured by the author in the *Transactions of the Pathological Society*, vol. xi. pp. 209-215.

callus is formed in the region of the necrosed bone. In a few weeks from the first of these symptoms, the sequestrum itself becomes loose, and is easily removed, leaving a large gap, and a raw granulating surface which rapidly heals. The necrosis almost always includes the bone which constitutes the loculi containing the developing permanent teeth, as well as the alveoli of the temporary; but it does not go further, and in the lower jaw the base of the bone is very rarely affected. I have never seen such an occurrence. The disease is usually symmetrical: when attacking the bone about the temporary molars on one side of the jaw (its most common situation), it generally manifests itself immediately after on the opposite side, and sometimes in the same regions of the other jaw. The same symmetry is observed in the front of the mouth.

As far as I am aware, this affection only occurs after the eruptive fevers,* and scarlatina is its most potent cause. In the instances which have been under my own care, two were after small-pox, five or six after measles, and fifteen or sixteen after scarlet fever. There is, however, nothing in the condition of the mouth to indicate which has been the precursor. The age at which this affection occurs is usually about five years: from three to eight are the extreme limits I have known.

The issue of these cases is simply comprised in the loss of a certain amount of bone with the contained teeth, and the consequent disfigurement. As the permanent teeth are lost with the temporary, the disfigurement is very great when it affects the incisors; but when the temporary molars and their successors, the bicuspid, suffer, the damage is comparatively slight. I have seen two examples of adults where this has happened in childhood, and the alteration of the face has been wonderfully little: the first molar approaches very close to the canine, and the second and third molars come well forward into the mouth, filling out the cheeks, and exhibiting no external evidence of what has occurred. In one solitary

* I have heard of one doubtful case after continued fever (typhus or typhoid); but this would form no real exception to these cases or their pathological interpretation. The continued fevers have their specific cutaneous eruptions; and their damaging influence on the tegumentary system is sufficiently attested by the falling of the hair in convalescents from them. I would not, however, be supposed to deny that jaw-necrosis, associated or not with death and exfoliation of other bones, may occur in children as the result only of extreme cachexia or depressed vital nutrition. Such instances are referred to in vol. iii. p. 642. I merely wish to assert my belief that the particular form of alveolar necrosis above described is one of the *specific sequelæ* of the eruptive fevers, and is related to its cause in the manner indicated in the foregoing page.

instance which I saw, in which the permanent tooth was not shed at the time when the bone and temporary tooth were lost,—it was in effect equally destroyed, for the tooth was blighted,—it did not grow after that time; no fang was formed, and when cut it remained a mere tooth-crown, loosely attached to the surface of the gum.

The *treatment* of these cases involves little beyond patience and cleanliness. No operative interference is indicated; the extent of the necrosis asserts itself from the first, and cannot be curtailed. Soon the sequestrum becomes loose, and may then be readily removed by dressing-forceps. I would suggest a weak solution of *perman-ganate of potass*, as a cleansing and deodorising mouth-wash. Any general symptoms of disturbed health should be met on ordinary principles. Where the suppuration is profuse, and the bone-necrosis extensive, stimulants and tonics may be required; and in the scarlet-fever cases steel would be a useful adjunct; but I would observe, that in the cases I have seen, the children were, for convalescents, in remarkably good health, and had, almost without exception, escaped the other ill consequences of the eruptive fevers.

VII. *Hæmorrhage after extraction of teeth.* Long-continued and obstinate bleeding after the extraction of teeth is an occasional and troublesome complication of this operation. It is not a common consequence; indeed it is very rare, considering the enormous numbers of the operations, and how seldom in proportion continued bleeding follows them. The troublesome hæmorrhage from the wound of an extracted tooth is of a peculiar character; it is not a rapid arterial discharge immediately following the vascular rupture which the tooth-extraction causes, but a continuous, abundant flow of blood welling-up in the empty socket, and developing itself into a serious and sometimes alarming symptom, usually many hours after the operation. The profuse pouring-out of vivid arterial blood, which sometimes follows the drawing of a tooth, has no relation to the circumstance we are considering; that generally lasts but for a few minutes, and then ceases. The continued hæmorrhage is not the discharge of any considerable arterial trunk that may have been wounded, as has been supposed, but the passive bleeding, as it seems, of the entire disrupted surface, from an inability of the vessels to accomplish the curative closure of their broken ends. In the majority of the recorded cases there has been distinct evidence of the existence of the hæmorrhagic diathesis in the individual affected; and in not a few, the patients have themselves been aware of the tendency, from having experienced similar

consequences attendant on the previous extraction of other teeth. Indeed some persons (I have some such patients of my own) refuse to have any more teeth removed, preferring rather to suffer any amount of toothache, on account of the alarming hæmorrhages which have followed the operations before. In one case which came under my treatment, there was no history of a hæmorrhagic tendency; but the patient was a young lady, and the circumstance occurred just as menstruation was imminent. The bleeding was very considerable, and continued for two days, when, under the influence of emmenagogues (hot hip-baths and aloetic purgatives), the catamenia appeared, and the hæmorrhage from the alveolus immediately ceased. In this case, doubtless, the bleeding was a vicarious manifestation of the periodic function. A very interesting example of this distressing consequence of tooth-drawing, showing its constitutional nature, was under my care some years since: a clergyman from one of the midland counties came to town to me on account of the hæmorrhage which had followed the extraction of a lower molar tooth three or four days before, and was still continuing. He was reduced to a pitiable condition of exhaustion and bloodlessness. All the local means usually adopted had been tried, but without success: the bleeding, however, speedily ceased under the use of large and frequently-repeated doses of *tannin*. The history of this gentleman and his family is curious and instructive. As a boy, from the most trivial accidents, such as a cut finger, he sustained prolonged and almost irrepressible bleeding: during his whole life, the slightest blow or bruise would cause a large and very disproportioned ecchymosis; a few years before, he had sustained a week of hæmorrhage, after the extraction of a tooth. This gentleman has three married sisters, all of whom suffer from terrible floodings at the birth of each child. He has a little boy, as liable to bleeding from a trivial wound as he was in his childhood.

It is of especial importance to bear in mind the general and diathetic nature of alveolar hæmorrhage, in devising its proper treatment. Any thing which would increase the wound, or add a fresh one (such as the cautery or the ligature of an arterial trunk), is contra-indicated. A fatal example of alveolar hæmorrhage, in which both these means were adopted, is recorded in an early number of the *Medico-Chirurgical Transactions*.* The previous his-

* "A Case of fatal Hæmorrhage from Extraction of a Tooth," by Richard Blagden, *Med.-Chir. Trans.* vol. viii., 1820.

tory of this patient is singularly like that of the clergyman whose case I have just mentioned, in the hæmorrhagic diathesis manifesting itself in childhood, and his having sustained a terrible loss of blood—the bleeding lasting for twenty-one days—when another tooth was extracted before. In the treatment of this fatal hæmorrhage, the actual cautery produced only a temporary arrest of bleeding; it was then determined to tie the carotid artery: the operation was performed by Sir B. Brodie, without any relief to the original symptoms; the wound in the neck only furnished another bleeding surface, and evidently hurried on the fatal catastrophe. In another recorded case where the cautery was used, the edge of the lip was accidentally burnt, and the surface thus cauterised soon commenced bleeding profusely, and continued to do so till the fatal termination of the case, which was hastened by it.

The *treatment* of this form of hæmorrhage divides itself into local and general; the local treatment consisting in the application of styptics, with continuous pressure upon the bleeding surface; the general treatment, in the rapid and abundant administration of internal astringents. The local plan of a plugging compress, recommended by Hunter, is that now universally adopted: “In general it will be sufficient to stuff the socket with lint, or lint dipped in oil of turpentine, and to apply a compress of lint, or a piece of cork thicker than the bodies of the adjacent teeth, so that the teeth in the opposite jaw may keep up a pressure.

“It has been advised to stuff into the socket some soft wax, on a supposition that it would mould itself to the cavity, and so stop the bleeding: this, perhaps, may sometimes answer better than the other method, and therefore should be tried when that fails.”* The restoration of the extracted tooth to the socket has also been tried with success. For the purpose of forming a plug of lint, a strip should be cut of an elongated wedge-shape, and this should be introduced, the pointed end first; the extremity should be introduced into the bleeding socket, and driven well home to the bottom; the strip of lint should then be folded and re-folded upon itself, so as to make the plug very solid and pressing on the entire superficies of the socket. When the compress of lint or cork has been applied, the mouth should be closed and the jaws kept permanently together, so as to exert considerable and persistent pressure by means of a broad bandage tied under the chin and over the head. Where the op-

* *A Practical Treatise on the Diseases of the Teeth*, by John Hunter, Lond. 1778, p. 92.

posing teeth in the other jaw are wanting, it may be difficult to keep up the compress-pressure by the mere closure of an edentulous jaw upon the bleeding alveolus. Mr. Higginbottom, of Nottingham, was I believe the first to invent what he called an *alveolar tourniquet*.* It is an instrument consisting of two blades, or shafts, united at one end, and capable of approximation and compression by means of a screw, and free at the other extremities; these latter are armed with pads, one applying to the compress in the mouth, and the other to the exterior: where the bleeding is in the lower jaw, the blades are nearly equal, the exterior one simply passing under the base of the horizontal ramus; for the upper jaw the instrument is less applicable, and the outer blade requires a long curved sweep, so as to grasp the top of the head. Various local astringents have been recommended in conjunction with the lint-plug; matico has been highly spoken of: I have found an alcoholic saturated solution of tannin answer the purpose very well; but probably the old remedy, turpentine, has never really been superseded.

I am convinced, however, that it is a great mistake only to treat these cases topically; they are most obviously manifestations of constitutional vice, and require a corresponding general treatment. Astringents should be had recourse to at the earliest stage; they can do no harm, and may be suspended at any time, while in the majority of cases they will be most beneficial. These cases often extend over so long a period that constitutional treatment has abundant time to be brought into full operation. Tannin and turpentine have been the most successful of internal remedies in recorded cases; with the latter drug, steel might be advantageously combined, especially in the form of the muriate tincture. In the irritability of sanguineous exhaustion, opiates may become necessary in large doses.

Other circumstances require attention; the patient should occupy a cool apartment, and local icy applications may be beneficial. The upright posture is to be preferred; or if the patient goes to bed, he should be bolstered up in as elevated a position as possible, while the circulation in the lower extremities should be encouraged.

In women during the menstruating period of life, it should not be forgotten that the hæmorrhage may be associated with suppressed menstruation, and constitute a vicarious discharge; and remedies should be adopted to meet this contingency.†

* "On Arrest of Bleeding after Extraction of Teeth," by J. Higginbottom, F.R.S., *Prov. Journ.* vol. iv., 1842.

† On the Hæmorrhagic Diathesis, see vol. i. pp. 656 et sqq.

VIII. *The application of obturators and false palates in cleft palate, &c.* The title of this section is scarcely in keeping with the heading of my essay—"Surgical Diseases connected with the Teeth, &c." The maladies which give rise to perforations and clefts of the palate are, practically speaking, never dependent on diseases of the teeth; but the particular region of their resultant defects, and the nature of the mechanical dentist's art, as remedying those defects, bring this matter fairly within my province.

The two forms of cleft or perforate palate, congenital and induced, are very unequally suited to this particular plan of treatment: a large number of the former may be radically cured by means of surgical operation, which is always preferable where practicable; in the latter cases, the mechanical assistance of obturators is of more avail, and, in many instances, not only removes an existing defect for the time being, but is to a great extent curative.

In congenital cases, when *very* severe, this is the only method applicable for the treatment of the great physical defect, no operation being capable of bringing into apposition the separate masses on either side of the cleft, or of remedying the defect of soft parts, which require to be supplied by new and foreign material.

When the cleft or perforation consists of an aperture in the hard palate only, as in most syphilitic and scrofulous cases, and some congenital, an arch of metal or other hard substance spanning over the orifice, and firmly applied to the contiguous palatal surface, is all that is required. When, however, it extends backwards and involves a destruction of the velum palati, and that to an amount which cannot be remedied by surgical operation, it becomes necessary to add to the metallic arch an elastic flap (such as vellum or india-rubber), which will supply the mobile functions of the soft parts as they are when in a normal condition. The former apparatus may be styled *obturators*, the latter *false palates*.

The material of which obturators are made may vary; carved ivory, vulcanite (indurated sulphuret of caoutchouc), or flattened metal,—gold, palladium, or silver,—are all employed. The first, however, is now generally discarded from its perishable nature. Vulcanite has been extensively adopted; but its thickness, and fragile character when very thin, militate against it. I much prefer sheet metal, on account of its strength, thinness, and durability. Silver or palladium may be employed for hospital purposes; but gold is far better, and I am in the habit of using it altogether. It is an object to have the sheet of metal as thin as possible without weakening it; and I employ the gold plate reduced to No. 6 of the

gold-flatter's gauge, being somewhat thinner than is usual for the frames on which artificial teeth are mounted. This degree of tenuity is quite compatible with entire firmness, and it receives better all the inequalities of the rugous palate: when a plate of this thickness is perfectly adapted to the palatal arch, it is scarcely appreciable to the wearer. As long as sound teeth remain in the upper jaw to which the plate may be attached, it should be supported by means of clasps or collars embracing them; when these are lost, the same object may be achieved by connecting the obturators by means of springs with a frame resting on the lower jaw. Under no circumstances whatever ought support to be obtained either by dilating sponge, or by hooks, or other processes passing into the nasal cavity—the effect of which is to increase the size of the orifice, or prevent its natural tendency to contract. The old and still very common method of treatment, consisting of a disc of metal with a piece of sponge attached to its upper surface passing into the nose, cannot be sufficiently reprehended: it is filthy in its nature, and most injurious to the unfortunate patient's future condition, as the pressure of the expanding sponge causes progressive absorption of the margin of the orifice to an unlimited extent. Any plug kept in position by tight-fitting acts in the same manner. There is a preparation in the museum of St. Bartholomew's Hospital (ser. i. no. 232), of the skull of a person who lost a portion of the palate, probably by syphilis, and who obtained temporary relief by stuffing the oro-nasal aperture with a large cork, gradually adding to the size of the plug to meet the requirements of the ever-increasing orifice, till the whole of the hard palate had disappeared, the palatal processes of the ossa palati as well as those of the maxillæ being lost. The progressive absorption under this continually-advancing pressure had removed the vomer, the inferior turbinated bones, and the nasal wall of the maxillary sinuses. Such a specimen is an eloquent commentary on this reprehensible plan of treatment.

But an obturator passing over the perforation is not negative in its effect. An orifice which, allowed to remain open, may continue *in statu quo*, or contract in a degree scarcely appreciable, will often rapidly diminish in size when the passage of air and fluid between the oral and nasal cavities is prevented. This is not generally known or understood; but it is of great importance in treating these cases. The obturator should be applied as early as possible,—as soon as the dead bone has come away, and while the wound is in a state of granulating activity. It is surprising how the granulations will stretch across the upper surface of the obtu-

rator, and close up the orifice ; and, in more advanced and neglected cases, the same condition may be imitated to some extent by frequently scarifying the edges of the perforation, always taking care immediately to restore and keep in place a well-fitting obturator. Why the removal of the ill-effects of a perforate palate (passage of air and fluid from nose to mouth, and damaged voice), by means of mechanical appliance, should lessen or remove its cause, is not very apparent: it seems a curious transposition of events, an inverted sequence: perhaps the protection afforded by the plate to the granulating edge may to some extent account for it: it is, however, true, and very important practically.

Occasionally a portion of the floor of the antrum is lost by necrosis in cases of severe "abscess" of that sinus, and its cavity becomes common with that of the mouth, by an aperture of variable size. This orifice should be immediately closed, or rather spanned over, by a plate (upon which substitutes for the lost teeth may, or may not, be fixed), and the result will be, in many instances, the development of a membranous growth supplying the lost bone, completely scarring over the wound, and forming a floor to the sinus.

When a cleft, congenital or accidental, passes into the soft palate, the application of a mechanical remedy does not, as far as I know, in any way encourage or assist a natural restoration of parts; the gaping continues unabated. It is necessary here, if surgical operation cannot bring the soft parts together, to supply the deficiency, not only with that which will compensate for hard palate, but with a material equivalent, as far as possible, in physical characters to the velum pendulum palati; and for this purpose nothing answers so well as common sheet vulcanised india-rubber not indurated. This, I believe, was first practically applied by Mr. Stearns,* and subsequently, in a simplified and efficient form, by Mr. Sercombe.† To the essays of both these gentlemen the reader is referred, as the author cannot further dwell upon a matter so exclusively belonging to the functions of the mechanical dentist, in an essay which has already exceeded its allotted limits.

S. JAMES A. SALTER.

* "A new Instrument, designed to remedy the Imperfection of Speech consequent upon Congenital Fissure of the Soft Palate," by C. H. Stearns, *Lancet*, vol. ii. 1845, pp. 7, 260, 284, 310.

† *Transactions of the Odontological Society*, vol. i., Lond. 1858.

DIPHTHERIA AND CROUP.

A FEW years ago the name of Diphtheria was unknown in England. It is highly probable that the descriptions of some of our older writers refer to this disease, which no doubt appeared then, as now, in an epidemic form; but for a very long period England had been free from its presence, and our acquaintance with its symptoms and consequences was till very recently wholly derived from observations made in France, where it had been known and studied for a number of years. A lingering doubt, however, remained in the minds of many on this side the Channel, whether it did really differ from our own croup, or might not perhaps be explained merely by an unusual prevalence of croup during the existence of an epidemic of scarlatina. Careful observation seems to show that it is distinct from both these diseases, but yet its relationship is in many respects so close that no better description can be given to one not conversant with the disorder than that it holds a place intermediate between them. It partakes of the febrile character and epidemic influences of the one, and of the specific exudation of the other; it combines general symptoms which belong specially to the fever, with local symptoms which belong wholly to the inflammation: and when it kills, it does so either by the general exhaustion which characterises more or less all epidemic diseases, or by the suffocation which depends on the exudation of croup.

With all this, it is a very remarkable fact that the spread of diphtheria generally coincides with the prevalence of scarlatina. Since it first made its appearance in England, the same observation has come from so many quarters that it is impossible to regard it as a mere coincidence. Indeed it has formed one of the great obstacles to our acquiring definite information regarding it, that the two diseases have so constantly run alongside of each other, and so completely merged into one another, that it has been difficult to separate them, and to distinguish between the effects produced by each. It has not unfrequently happened that in the same family, within a very short period, one member has suffered from diph-

theria, and another has had an attack of scarlatina, and each has been so marked as to leave no doubt on the subject: but if the cases were not so clear, or if, as has often happened, the question of diversity was never raised at all, the two sets of symptoms have been set down to the same cause, and false inferences drawn as to the true character of the disorder.

This circumstance has no doubt given greater vagueness to the descriptions of the older writers than would otherwise have been the case, but the conclusion is unavoidable that cases occurred in their practice also, and that doubts had often arisen as to whether it was or was not a form of scarlet fever. They were not conversant, as we are, with the exudation-process, and did not discriminate between patches of lymph resting upon the surface of the mucous membrane, and a slough involving its superficial layer. They were indeed surprised that when the layer was detached, the membrane was found healthy beneath it; but pathology was not sufficiently advanced to draw intelligent conclusions from such observations, and we can gather little from the past that can be of use in the consideration of the special character and treatment of this disease.

History. The first observations which, in this country at least, led to a true understanding of the nature of that false membrane which so eminently characterises diphtheria, were made with reference to sporadic croup by Dr. Home,* about the middle of last century. He first recognised the existence of a mass of fibrin, moulded to the form of the subjacent structures, and adherent to the mucous membrane, but lying quite upon its surface, "and generally lying loose upon it." Prior to this date such exudations were supposed to be part of the membrane itself, detached in the form of a slough. His descriptions, as well as those of Dr. Cheyne,† forty years later, prove that in the sporadic croup of those days the exudation was confined to the trachea, and did not spread to the fauces.

So truthful were these descriptions of croup, and so entirely did they correspond with the experience of British practitioners, that we were for some time disposed to doubt the correctness of our neighbours' observations; just as they imagined that there must be some error in our way of regarding croup, because it was so unlike

* *An Inquiry into the Nature, Causes, and Cure of the Croup*, by Francis Home, M.D.

† *Essays on Diseases of Children*, by John Cheyne, M.D.

what they were studying in the epidemic sore throat, which some years ago began to attract attention in France. Yet each was correct in its own place, because the two diseases were perfectly different in their origin, although presenting such a curious coincidence as the existence of false membrane, at that point where its presence interfered with one of the most important functions of life, and not unfrequently caused death by suffocation.

Bretonneau, in his *Memoirs** read before the French Academy in 1821, was the first to give a scientific account of the epidemic disease; and its symptoms have undergone so little change, that his report continues to be a very faithful picture of the usual forms which it presents, although his theory of the local character of the disease has been now almost entirely abandoned. Till very recently this view was maintained by many of the best French pathologists; and Trousseau has perhaps been the last to yield the point, that the empoisonment of the blood, as exhibited in the general symptoms, was not merely a consequence of the local affection, and of the absorption of some material connected with the exudation. This question, though in itself one of mere abstract reasoning, which could be put to no precise test of its truthfulness, yet reached far beyond the battle-field of opposing theorists; for it offered a satisfactory reason for endeavouring promptly and effectually to remove the exudation by local applications, while it led to the overlooking of such measures as were calculated to counteract a blood-disease, which it was assumed could be prevented or cured only by the removal of the local affection. The practice thus introduced has continued more or less to form the basis of very many of the modes of treatment, and with too many the aim has only been to discover the most efficient local remedies, instead of seeking to overcome the general disorder of which we now believe the exudation to be only a part.

Symptoms. The main symptom on which reliance is placed in the diagnosis of diphtheria, is the presence of false membrane. Like many other diseases with which we are only imperfectly acquainted, one prominent symptom, the first indeed which led to the recognition of a separate and distinct form of disease, has almost usurped the place in nosology which belongs to the blood-poison which gives it birth. But the more we are compelled in our ignorance to rely on one pathognomonic sign, the more surely are we exposed to the risk of error in the conclusions at which we

* See *Memoirs on Diphtheria*, published by the New Sydenham Society.

arrive. The characters of the sign may seem to be very definite when a well-marked example is presented to us; but if it be at all obscure, we are forced to look for other indications to aid our judgment. In the investigation of diphtheria we are met on the threshold with a very prominent fact, which gives it a place at once in our nosology as a blood-poison; for so we must at present call it, while confessing our ignorance of what blood-poisoning means. It comes to us under the form of an epidemic; it attacks one individual after another; it breaks out in a given locality; singles out a certain proportion of the community for its attacks; and then disappears. We ask how it came, and how it went; and the answer must be necessarily somewhat vague. Sad experience has proved that persons who have been accidentally inoculated, so to speak, with the exudation, have caught the infection and suffered from the disease. And as with other inoculable diseases which are also certainly conveyed from the sick to the healthy through the atmosphere without any actual contact, so with this there seems every reason to believe that in certain investigated instances the infection has been so propagated; and we can hardly withhold our assent to the proposition that it may be so in all, although it is not always, perhaps not often, possible to trace the source of the infection, and the means of its transmission. It matters not, however, whether the theory of the contagionists or of the non-contagionists be proved the true one; the fact still remains, that diphtheria has all the known characters of an epidemic. It is not meant to assert that no isolated case can be diphtheria, but all such must ever be received with suspicion; and if the case be really isolated, it will probably be found wanting in some of the distinctive characteristics of the disease, and may possibly be referred to some other form of throat affection.

But while it is admitted that the epidemic character is essential to the existence of diphtheria, it is somewhat difficult in the presence of an epidemic to discriminate cases which might have occurred as simple sore throat in its absence. The mucous membrane is perhaps only simply redder than usual; it may have a slight glazy exudation, or even that may be wanting. And the only peculiarity consists in the cases being very numerous, and there being no tendency to suppuration or ulceration, as the result of the inflammatory action. Such affections of the membrane of the throat always accompany the spread of the genuine diphtheritic inflammation; and our definition must be made wide enough to embrace them, because although the chief pathognomonic sign be

wanting, yet they are, without doubt, part of the epidemic, and quite as essential to a right understanding of the disease as the more marked forms to which the name is more truly applicable.

Definition. Diphtheria may, then, be characterised as a blood-poison propagated by transmission through the atmosphere in the majority of instances, either as a miasm from the bodies of the sick, or in consequence of some atmospheric changes as yet unknown to us. This poison, after the lapse of a very few days from the date of exposure to infection, produces a general febrile action throughout the body, and a distinct local inflammation limited to the membrane covering the throat. Quite exceptionally, deep-seated abscess may form in consequence of it; but most commonly there is only simple inflammation of the glands of the neck, which are tense and tender: these accidents, however, are not essential to the disease in the same sense as the specific action on the mucous membrane.

Albuminuria. In addition to this, an albuminous state of urine is very common in the severer forms of diphtheria. As in scarlatina, the presence of albumen is simply due to congestion of the kidney; and we conclude that in some way or other the vitiated or poisoned blood stimulates the capillary vessels so as to produce this state of congestion; but we have as yet no clue to unravel further the mystery. In the one disease the urine presents no trace of albumen during the acute stage, the congestion only appearing with the desquamation of the cuticle, after the febrile condition—the scarlet fever, so to speak—has passed off; in the other it commences at a very early period of the disease, generally lasts only for a few days, and does not cling to the patient during convalescence, as is the case so often in scarlatina. It causes no surprise that we cannot explain these peculiarities, when we have no idea why the complication exists at all, when it does not accompany any other form of sore throat, nor any other analogous febrile disorder.

Paralysis. Another phenomenon accompanies or rather follows upon attacks of diphtheria with sufficient frequency to establish a certain relationship between them; but as yet we can only affirm that paralytic affections may be apprehended after partial convalescence from diphtheria, after indeed the throat has got perfectly well, and nothing seems wanting to recovery but the due performance of the nutritive functions. This must be the gravest of the sequelæ, if it be true that patients die of paralysis of the heart* when no lesion

* *Diphtheria, its Symptoms and Treatment*, by Wm. Jenner, M.D., pp. 42-59.

whatever can be traced after death. The paralysis most frequently affects only the muscles of deglutition and of speech, but does also sometimes include nearly all the muscular tissues throughout the body; the sight becomes impaired through loss of the adjusting power of the eye,* the pulse fails apparently from diminished nervous energy in the heart, the legs and arms become partially powerless, and sensations of tingling and numbness are complained of, or actual anæsthesia exists.

Diphtheritic fever. The primary action of the poison when imbibed into the system is an alteration in the character of the blood. This we infer, in the first place, from the sense of malaise, the febrile action, in some instances very slight indeed, but in some very severe, which can be traced before any local manifestation occurs. This fever alone may kill, and when it does so, it is always by its assuming an asthenic or typhoid character; the patient either becomes daily weaker, and ultimately dies of exhaustion, or the case is marked by low muttering delirium, with a tendency to slough about the inflamed mucous membrane, excessive prostration, and rapid sinking; in either case the pulse is feeble and very frequent. It is to be borne in mind that this is the invariable character of the disease, however inflammatory the fever may in the first instance seem to be. In the second place, we infer the existence of blood-poisoning from the occasional appearance of purpura and sanious exudations in fatal cases, and the constant sequel of intense anæmia, even in comparatively mild cases, during convalescence.

These peculiarities are very striking, because the depression resulting from the attack is out of all proportion to its severity; and even when the fever is manifestly typhoid in its character the subsequent weakness seems very much greater than might have been anticipated, and may end in a gradual but total failure of vital power after all danger had seemed to be at an end.

The fibrinous exudation. The next immediate effect of the poison is the local action on the mucous membrane of the throat, which looks from the first swollen and red, as if it were the seat of active inflammation. And such no doubt it is; but it is a specific, and not an ordinary inflammation. It is quite different in character and consequences from the ordinary inflammation of mucous membrane, and bears some analogy to that which is more commonly restricted to serous membrane, being perhaps most unlike in its tendency to

* *Diphtheria*, by E. H. Greenhow, M.D., p. 229.

localisation. We are all perfectly familiar with the rapid spread of the inflammatory blush, from a single point, over the whole involutions of the peritonæum, with its sticky, glazy, and fibrinous exudation; we see the same exudation forming a thick shreddy coating all over the heart, or lining the entire cavity of the pleura. In diphtheria we have the same character marking the exudation, but the parts involved do not extend as far as the limits of the membrane. In many cases the patches of lymph are few and small, and the inflammation is confined to the back of the throat. In a certain number of instances the trachea, and even the bronchi, are involved; not unfrequently the membrane lining the nares is attacked more or less extensively; more rarely it travels down the œsophagus; and in a few cases it reaches up the lachrymal duct to the surface of the eye. The laws of its extension seem to be much more in harmony with those of mucous than of serous inflammations, and there is but little difference in this respect between diphtheria and ordinary sore throat, which may either be limited to the fauces, or may be the commencement of a catarrh, ending in a general bronchitis. The character of the exudation varies very much in the same manner. When the extent of inflamed surface is small, the effusion is scanty, and the deposit of fibrin of less thickness and consistency; when the inflammation is more extensive, it is generally also more intense, and the effusion is thicker and denser, deeper and firmer. But there is no absolute rule in this respect. The fibrin is exactly analogous to that which usually covers inflamed serous membrane, presenting not only the same general appearances, but also the same microscopical elements.

It was at one time supposed that the discovery of a microscopic fungus had given an explanation of the whole pathology of diphtheria. Competent observers have, however, shown, not only that the exudation may exist without any trace of the parasite in its substance, but also that the very same form of vegetable life may be seen occasionally in some of the secretions of the mouth when no symptom of diphtheria, and no exudation of fibrin, were present.

The ordinary consistence of the effusion is such that it is often called false membrane; but it is sometimes scarcely more cohesive than paste, and contains more granular matter and cells than fibre in its structure. The mucous membrane on which it rests is almost always redder than usual; and when the fibrinous layer is removed, it looks raw and irritable, as if denuded of its epithelium; and it is generally dotted over with bloody points where

the adhesion has been closer, or the exudation has entered the mucous follicles, and torn the tissue in its removal.

The diphtheritic exudation is not, however, confined to the mucous membrane of the throat, although probably always to be found there in a true case of diphtheria. It is to be seen very constantly on the skin when the cuticle has been removed by a blister; and it is alleged that the contagion of the disease has spread in this way to persons who have had blisters applied while living in rooms where others have been suffering from diphtheria. Any ulcerated or abraded surface, in persons labouring under the disease, may similarly become coated with false membrane; and not unfrequently the mucous membrane of the pudenda in female children is the seat of a similar exudation. Suppuration of an unhealthy kind sometimes attacks the mucous membrane beneath the exudation, which melts away with a gangrenous odour, leaving a slough or a foul ulcerated surface behind; and then the whole course of the disease may be changed, and the patient may fall into that low typhoid condition which is believed to be caused by the absorption of unhealthy pus.

The mere fact of exudation having taken place, apart from its value as an indication of the severity of the attack, claims our most earnest attention, from its occasional bearing on the issue of the case as a local ailment. It is not the extent of surface attacked which excites apprehension, but the importance to life of the small chink through which air is drawn into the lungs, and the readiness with which a very small amount of thickening, or a very slight deposit on the membrane covering the chordæ vocales, may obstruct the entrance of air, and cause death by suffocation. It would appear that in different epidemics the tendency of the inflammation to spread to the larynx has varied very greatly; sometimes a majority, sometimes but a small number, of the deaths resulting from this circumstance.

It is at this point that the epidemic disease comes into close relationship to the endemic inflammation of the trachea in children, known as croup. The termination of the case when death results from apnoea is identical in both diseases; the fibrinous exudation, so unusual in inflammation of mucous membrane, is also identical in the two diseases, but so far as we know, the cause is different. The diseases appear to be entirely distinct: the one communicable, the other having no tendency to spread; the one a simple inflammation, the other a specific fever; the general disturbance in the one case only such as is produced by the local

inflammation and the difficulty of breathing, while in the other the local disorder is only one manifestation among many of a previously existing condition of blood-poisoning by which the fever is caused.

Treatment. The fatal termination of an attack of diphtheria may follow either as a remote or immediate result of the fever itself, or in consequence of the obstruction of the larynx by local exudation; and the treatment must vary as the one or the other of these circumstances seems to be the most fraught with danger. Like the other acute specific diseases, diphtheria must be treated on general principles, inasmuch as no specific remedies have yet been discovered which have the power of destroying the blood-poisons on which they severally depend. Probably no such remedies exist. The condition of the blood during the incubation of a fever, while an infinitesimal portion only of the poison has been absorbed, must be very different from that in which the poison is again generated in unmeasured quantity, and is passing off from the patient's body to attack others who are brought within its range: and a remedy which might avail in the one condition would be useless in the other. If, as we apprehend, diphtheria is in this respect analogous to small-pox, the plan of treatment must necessarily vary with the duration of the disease, the intensity of the blood-poisoning, and the power of resistance on the part of the patient. Any specific, if such there be, can only act as a preventive, hindering the blood-changes from commencing, and cannot very well be supposed to put a stop to their progress when fully developed. The spoilt material can only be got rid of by elimination; fresh blood must be formed to take the place of that which has undergone a process of deterioration. On these broad principles must our treatment be based with reference to the fever itself; the local disease demands separate attention and different remedies.

1. In some rare cases the patient is at once prostrated by the severity of the fever; he has a brown tongue, a quick and feeble pulse, probably purpurous spots on his body, or a sanious discharge from the nose or fauces, and occasionally muttering delirium. Such cases rarely show any signs of rallying; and the freest use of stimulants affords the only chance of saving the patient or enabling him to recover from the shock of the attack.

2. If not thus prostrate from the very first, yet generally from an early period the tendency of the disease is to assume a low or asthenic type; and depressant remedies must be carefully avoided. In some cases the local inflammation is severe, and the fever is proportionately acute, and for a few days mild salines may be

indicated; but even such treatment must not be persevered in too long, and the depression which follows must be met or even forestalled by the administration of stimulants. The difficulty of swallowing must not be permitted to interfere with the quantity of nourishment taken; patients who escape the first severity of the disease are still exposed to the danger of a lingering convalescence, or a gradual exhaustion of the vital powers; and hence the importance of a sustaining mode of treatment. Chlorate of potash, hydrochloric acid, and muriated tincture of iron, are the constitutional remedies on which, according to the testimony of most writers, the greatest reliance is to be placed, combining them with diffusible stimuli or tonics, as the particular case seems to require. Each has been vaunted in turn as almost specific, and each has notably failed where it has been so misapplied. Chlorate of potash acts so completely as a charm in some cases of *cancerum oris*, that it is not unreasonable to suppose that it may act beneficially where there is any analogous condition of the mucous membrane; in the purely non-ulcerated form of diphtheria, it is less likely to do good. Hydrochloric acid, either alone or in combination with the chlorate, is well known as a gargle and drink in scarlet fever. It seems to act partly as a local stimulus to the throat, and partly as a general blood alterative, especially in those forms of the disease in which the appearance of purpura or sanious discharges proves that important changes have taken place in the condition of the blood. Iron in all its forms is so distinctly the remedy which tends to restore the blood to its healthy condition, that its use cannot be dispensed with in a disease of which blood-changes are the commencement, and anæmia the usual termination. The tincture of the sesquichloride has appeared to act most beneficially in some cases of erysipelas, and its local astringent action seems to render it especially suited for the treatment of this disease. In some cases it has certainly answered even beyond expectation.

3. Foul and unhealthy suppuration not only aggravates the general disorder, but may lead to the supervention of blood-poisoning of another kind. Pyæmia, as it is called, must be regarded as a most dangerous complication of diphtheria. Ulceration of the mucous membrane shows that the vitality of the patient is low, and calls for increased activity in the administration of stimulants and tonic remedies, while every attempt is made to convert the foul suppuration into a healthy sore, to prevent the possibility of the absorption of unhealthy pus into the system. If secondary abscesses begin to form, the liberal employment of wine and brandy, with

large doses of opium, gives the only chance of recovery. The extent to which both opiates and stimulants are borne in such cases is quite surprising.

4. The local disorder claims our attention more especially when it spreads towards the larynx and trachea. The idea that the extent of the exudation was the cause of the severity of the symptoms has been entirely abandoned, and with it that meddling activity which deemed it necessary to apply caustics or astringents several times a day to the throat. An abraded surface, whether of cuticle or mucous membrane, is speedily covered with the diphtheritic exudation in the severer forms of the disease, even when no contact of parts is possible; and it would seem perfect madness to apply an escharotic which tends to denude the adjacent membrane of its epithelium, and prepare it for the fibrinous exudation which is certain to take its place. Such treatment, however, has been adopted, under the mistaken idea that local means could check the constitutional malady. The circumstances which seem to demand local applications are the rapid spread of the exudation, and the existence of ulceration. The application must be astringent, not escharotic; a stimulant to the diseased surface, not a destroyer of its vitality. By occasional sponging with a solution of the sesquichloride, or a very dilute mineral acid, or a weak solution of lunar caustic, we may hope to prevent the exudation reaching the larynx, or the ulceration assuming an unhealthy character; but the power of such means is allowed on all hands to be very limited.

When the larynx is also involved in the exudation, dyspnoea, and insufficient aeration of blood, add very materially to the sufferings of the patient, and the probability of a fatal termination; and the question naturally presents itself, whether any, and how much, benefit may be anticipated from the operation of tracheotomy. It is by no means easy to give in few words a definite answer to this inquiry, or to lay down rules which may be sufficient to guide the practitioner in deciding on his course. If we turn to statistics, we find that the fatal termination is not averted to any great extent, although in all probability some lives have been saved by the operation, which must otherwise have been lost. But it is manifestly impossible to frame a series of cases in which it has not been performed which shall be an exact counterpart to those operated upon; and without such a basis of comparison, the knowledge of the exact number of deaths and recoveries after operation is valueless. It is indeed asserted that of late years the mortality in France after tracheotomy is not nearly so great as formerly; but this may

depend not so much on the results being more favourable, as on a more hopeful series of cases being selected. In such circumstances we must be guided more by general principles than by experience, and the rules for our guidance must be admitted to be based partly on conjecture. It may be assumed, then, first of all, with tolerable confidence, that when the general symptoms indicate that the attack is comparatively mild, while the danger of suffocation is imminent, tracheotomy does give a chance of life in cases otherwise all but hopeless, and that it certainly does give prompt and certain relief to the suffering immediately caused by dyspnœa, than which nothing is harder to bear. But no Surgeon ought to undertake the operation, even in such circumstances, without fully explaining that relief, and relief only, from impending suffocation is its object. Secondly, when the dyspnœa is less intense, it becomes a question, whether the relief to the breathing may not help forward the process of cure which nature is working out; or it may rather be said, whether the existing amount of dyspnœa does not materially hinder the recovery, and render it more uncertain. The French Surgeons are disposed to answer in the affirmative; and the opinion is shared by many among ourselves; but the practice is clearly not one that can be urged as necessary in the present state of our knowledge. Thirdly, in the very severe forms of the disease, we may well pause before recommending the operation, because it is no longer a question of the possible saving of life, but one merely of giving temporary relief. The patient is in a condition most unfavourable for the operation; and even setting aside the chances of an immediately fatal result, the fact of the operation having been performed is very apt to tell unfavourably on the issue. In addition to this, we must remember that the operation may even fail of giving relief, in consequence of the trachea and bronchi being blocked up by false membrane. In such cases it can only be justified by intense dyspnœa and impending suffocation, and by the earnest longing of the patient, or the friends, to have something done to procure relief. Could we know with any degree of certainty how far the exudation extended into the trachea and bronchial tubes, we should have most valuable information to guide our decision. Auscultation should with this view always be carefully practised; but it must be confessed to be a matter of extreme difficulty, and one which the most experienced stethoscopist will fail to determine with accuracy.

5. During the prevalence of the epidemic many slight cases occur, which assume more or less its specific characters, and are

marked by the presence of small shreds of lymph on the fauces. An ordinary sore throat at such times does not follow its usual course, but without manifest exposure to infection is somehow assimilated to diphtheria. These generally require no special treatment, and will in all probability end in recovery without the aid of medicine. We have only to remember the tendency to depression which accompanies all the well-marked instances of the disease, and therefore in all cases we must carefully avoid any lowering remedies. No good can result from the local application of escharotics, while some risk is run of causing the exudation to spread more than it would otherwise do. Many a diphtheritic-looking throat is produced by the unnecessary application of lunar caustic in doubtful cases.

CROUP.

General characters. With the disease known by the name of croup, or tracheitis, as it has been sometimes called, the cynanche trachealis of Cullen, English medical men have been long familiar. Although occurring in particular localities at certain times with greater frequency than elsewhere, it presents none of the true features of an epidemic; it is much more truly endemic. It appears chiefly during the cold weather; it may visit the same locality year after year, wholly disappearing during the interval; but it does not spread to adjacent houses or villages, its victims being comparatively few, although several persons are usually attacked at or about the same time. In all these respects it has much more affinity with pneumonia than with such a disorder as diphtheria. Like the latter, however, it is marked by one very striking feature, viz. the existence, in a large number of instances, of false membrane as an exudation from a mucous surface.

With our present knowledge it is impossible to assign any reason for this peculiarity. There is no specific poison apparently introduced; the mucous membrane lining the larynx and trachea is simply inflamed; and in many cases the exudation is purulent or creamy-looking; but in the majority it is fibrinous, contrary to the usual laws governing the inflammations of mucous membrane. Why this is so, we know not; for an acute attack of bronchitis or lobular pneumonia, both not uncommon in children of the same age, is not attended by the same sort of exudation from the mucous surface of the small tubes. It is only when the inflammation attacks the trachea, and is localised there, that false membrane is formed; but it is scarcely to be hoped that we shall ever attain to a

knowledge of the circumstances which determine why one exposure to cold is followed by inflammation of the parenchyma of the lungs, another by that of the lining of the small tubes, while in a third the membrane of the trachea is alone the seat of the inflammation. It is this tendency to limitation which constitutes the specific character of each inflammation, and thus distinguishes croup from laryngitis on the one side, and bronchitis on the other. The peculiar form of the exudation is not less characteristic as a symptom of croup when it is observed, because of its not accompanying the other forms of pulmonary inflammation; but it is never safe to take any one symptom as pathognomonic of a disease, however close the relationship; and mistakes are constantly being made by those who rest satisfied with such methods of diagnosis.

The attack ordinarily sets in with acute febrile symptoms and a hard dry cough, which has a very peculiar sharp ringing sound, dependent on the changes which from the first occur in the larynx and trachea. The sound of the cough is so remarkable, that, when a child produces this brassy tone in coughing, the attendant is tempted to conclude, without further inquiry, that the disease is croup. There is very generally no difficulty in swallowing, any feeling of soreness of throat being confined to the windpipe, and not reaching the fauces. In some few instances, however, the inflammation is more general, and false membrane is seen on the tonsils and the back of the throat, just as ordinarily happens in diphtheria. The breathing is always hurried, partly as a consequence of the febrile state, partly because air enters the lungs with difficulty. As the disease proceeds, this difficulty increases, and the dyspnœa recurs in paroxysms, which become every hour more distressing. Such paroxysms often follow a fit of coughing, but occasionally come on without any apparent cause. In the expectation shreds of false membrane are often seen, and considerable relief sometimes follows its removal; but in the severer forms of the disease such relief is only temporary,—the exudation is renewed as soon as it is rejected, the breathing becomes more and more oppressed, the skin acquires a dusky hue, and ultimately is covered with cold perspiration. After several severe and ineffectual struggles for breath, the brain seems to be stupefied by the circulation of imperfectly-ventilated blood, and the patient sinks into unconsciousness.

Diagnosis. The site of the inflammation is specially the trachea; but its great fatality depends upon its involving also the larynx; and this too is the circumstance which directs our attention in the

early stages to the inflammatory action going on in that part of the breathing apparatus. Laryngitis is a disease of adult life; tracheitis is limited to childhood: hence, if the difficulty of breathing is caused by some condition of the larynx, we almost at once assume that in an adult we have to do with laryngitis, in a child with croup, when febrile symptoms are present, and there is nothing visible about the throat to account for the dyspnoea. Indeed we need hardly go any further in distinguishing the two diseases at first, because very soon some other symptom, such as the presence of false membrane, is pretty certain to decide the question. From bronchitis and pneumonia it is distinguished by the cough, by the existence of dyspnoea, and by the fact of this dyspnoea being traceable to the larynx. The spurious or false croup is much more sudden in its onset, and transient in character; the one disease is essentially febrile and inflammatory, the other spasmodic, free from fever, and dependent on nervous irritability. Between diphtheria and croup the relations are very close; and although it be quite true that the original site of the exudative inflammation is in the former the fauces, in the latter the trachea, yet there are very many instances in which at present the name given to the attack must depend simply on the consideration, whether the case occurred sporadically, or was one of such a number as could only be caused by epidemic influence. The doubtful instances are comparatively few; and during an epidemic, genuine cases of croup may very generally be distinguished, even though the epidemic element impresses on them, to a certain extent, its own characters and features. The chief symptoms which must be relied on for this discrimination are also those on which the treatment of the two forms of disorder is in great measure based; they are those which characterise the one as a fever, and the other as an inflammation. How much there is in such a distinction those only can tell who, regardless of theories, watch the actual condition of patients under either circumstances, and can feel assured, as they certainly may be, of the benefits of depletion and starvation in the one case, of the absolute necessity for supporting and sustaining in the other. The state of the skin and the pulse help us more in this matter than any other set of symptoms; fever is associated with more burning and pungent heat of skin, with greater frequency and less power of pulse from the earliest period of the attack, and is not often associated with perspiration. But though these point the way with reference to treatment, it is by constant and repeated observation alone that we learn in each case how far the type of the disease is of a sthenic

character, and are able to determine whether the patient will bear for a little while mere watching and starvation, or his tendency to prostration is such as demands our using from the first every means of support.

Treatment. Treatment embraces especially two points : 1st, the arrest of the inflammatory action ; 2d, the relief of the breathing. We cannot in this disease very often wait for such a change in the condition of the membrane as shall of itself bring relief to the breathing ; the patient may die of suffocation before the inflammation subsides, however energetic our remedies may be. The state of the skin and pulse, and the hurry of the breathing, lead us most naturally to salines and antimony, as the best means of accomplishing this end. If the patient be healthy and robust, a few leeches to the top of the sternum aid in emptying the vessels and checking the exudation. The extent to which these remedies are employed must depend mainly on the constitutional strength of the patient ; and in the event of diphtheria prevailing at the time, their employment must be still more sparing, because of the known tendency to depression which accompanies it, and seems to modify very much, for the time being, any coincident cases of sporadic croup. But even without any such complication, the mere fact of severe inflammatory action, with its exhausting and debilitating effects on the constitution, must put us on our guard against allowing the patient to be too much lowered by depletion, and demands a supporting plan of treatment at a comparatively early period, in the susceptible and rapidly-changing structures of childhood. The intention of this part of treatment is, if possible, to limit the febrile action before such an amount of exudation has been poured out as may run the risk of producing fatal suffocation ; we do not hope or expect to arrest it altogether.

Mercury has so long enjoyed a reputation as the most powerful solvent of fibrinous exudations, that it is almost always given in croup ; but one decided objection presents itself, that its action is too slow to be very available. If the patient survive long enough to be brought fully under its influence, the probability in favour of recovery is already considerable, and the result ought not to be set down to the mercury in very many cases in which it is given. Its usefulness is perhaps rather to be attributed to its action on the excretory functions.

The difficulty of breathing, as it depends in very great measure on the condition of the larynx, is to be explained partly by the simple fact of congestion, partly by the presence of false membrane.

The depressant remedies will aid in relieving the congestion and preventing the renewal of exudation, but are powerless as sedatives to remove the false membrane. Occasional benefit, however, is obtained by their administration in emetic doses, which, especially with children, seem to clear out the trachea while emptying the stomach; but our chief reliance where prompt relief to the breathing is demanded, and seems an unavoidable necessity, must be in the operation of tracheotomy. It is certainly more adapted to this disease than to diphtheria, in so far as the attack is local instead of constitutional, is an inflammation and not a blood-poisoning. The principal objection to its employment is found in the fact that the false membrane is rarely limited to the trachea, but also descends the bronchi; and although a sufficient amount of air may be admitted into the trachea, yet it cannot reach the lungs, because the bronchial tubes are choked up. English medical men seem now very generally to incline to the opinion that the operation, if not to be recommended, is at least justifiable, as it does not seem materially to increase the risk of a fatal issue, while affording in some cases the only chance of recovery; but, to be successful, that it must be performed at an early period of the attack. Such a practice is likely to meet with much opposition, from the prejudices of friends, who cannot see that there is any need for its performance; and, out of deference to their wishes, the operation is too often postponed to so late a period that it does little or no good. No operation of course can be undertaken without some risk; but it does seem that the risk attending tracheotomy must be greatly increased if it must be done in a hurry, with the immediate prospect of life being terminated by suffocation if the final plunge of the knife into the windpipe be a moment delayed. And at the same time the chance of ultimate recovery is very much diminished if the blood has become thoroughly poisoned with unexpired carbonic acid gas. The stethoscope may do something, but it cannot do much, in determining the question of how far the minute tubes are obstructed. The noise produced in the larynx and trachea generally drowns every other that might be heard; but if any sort of crepitation be audible, to undertake the operation of tracheotomy would be quite unjustifiable.

A. W. BARCLAY.

DISEASES OF THE MOUTH.

TONSILLITIS. *Quinsey. Cynanche tonsillaris.*—The most common morbid affections of the tonsils may be thus classed :

- 1st. Acute inflammation and abscess.
- 2d. Chronic inflammation and enlargement.
- 3d. Ulceration and sloughing.

1. *Acute inflammation* of the tonsils is generally preceded or attended by a sharp rigor, and general feverish disturbance. Accompanying or following such constitutional irritation, will be found pain in the fauces, and tenderness of the upper part of the throat, in every effort at deglutition. The pain at first is not acute, but rather as if the parts had been bruised, and is diffused over the back part of the mouth and the pharynx. As the case progresses, the local mischief becomes more evident. At first a mere blush, the redness of the part becomes more marked. With the altered colour of the mucous membrane tumidity of the tonsil will be observed, and before long œdema of the surrounding soft structures. With the increase in the severity of these local changes, it usually becomes evident that the mischief is confined to one side. But the evils of tonsillitis are not restricted to these symptoms alone, nor do the sufferings usually stop short here. Pains in the jaws, and headache ; fever and loss of appetite ; often severe suffering in the part affected ; a loaded, creamy, and swollen tongue, with very foul breath ; muffled articulation ; great difficulty in swallowing, and fluids attempted to be swallowed escaping through the nostrils ; great fear of strangulation ; the patient frequently obliged to sit forward, or lie on one side, to allow the abundant saliva to drip into a basin, or drain away on a sponge :—these are the symptoms which mark the progress of the complaint, and comprise the chief characteristics of the attack. As the attack advances, the local examination of the mouth detects an increase of swelling, which usually runs forward in the substance of the soft palate, and on the side affected ; in aggravated cases even as far forwards as the incisor teeth. With the increase of swelling, a central softening spot will sooner or later be detected, either with the eye, or more frequently at a comparatively earlier period, by an examination with the finger.

Much difference will be found, in different cases, as to the period at which pus is formed in an attack of acute inflammation of the tonsils, *i. e.* as to the period when the abscess may be relieved by incision. In some instances from forty-eight to sixty hours will suffice to insure such a desirable condition. In other cases, many days will elapse before matter can be detected by the point of the finger, or upon the thrust of a scalpel. During all this time the patient passes his days and nights in misery; is not able to take any solid food, and but little fluid nourishment; obtains very little sleep, and that little of a disturbed character; has difficulty in respiration, caused by some œdema of the glosso-epiglottidean and aryteno-epiglottidean folds, and often greatly aggravated by fear, and a nervous horror of approaching suffocation. Inflammation in the acute form attacking the tonsil seldom terminates in resolution: as a general rule, it runs into abscess. This abscess will burst sooner or later if left to itself; and when burst, the urgency of the symptoms will at once commence to subside. But if the abscess can be opened by the Surgeon a day or two previous to what would otherwise be the spontaneous period of perforation, by so much will the patient's suffering be alleviated.

The causes of this form of inflammation appear to be, more or less, associated with some disordered state of health, which renders the tonsils and throat especially susceptible to the influence of cold; for to direct exposure to cold may usually be attributed the immediate cause of an attack. But the patient will generally be found to have suffered from some constitutional disturbance, previous to the commencement of the sore-throat. Often he is of a gouty habit. Rigors and flushes commonly herald the attack, before the gland itself becomes the seat of inflammation. Abscess, the result of simple inflammation of the tonsil, irrespective of those cases which are complicated with scarlet fever, is a rare affection in childhood. It is seldom met with before puberty. It is not a frequent attendant on old age. It appears to be a disorder of youth and middle life.

It rarely occurs that both tonsils are simultaneously affected. But it does sometimes happen that after one tonsil has been the seat of suppuration, the opposite one becomes inflamed and runs into abscess. This, however, is infrequent. We occasionally meet with individuals who are subject to recurring attacks of inflammation of the tonsils, and quinsey. These attacks occur every one or two years for some time, often at shorter intervals.

Such conditions indicate especially, and prominently urge, the importance of constitutional treatment rather than simple attention to the local evil. It has constantly been found most serviceable, directly a patient has anticipated the recurrence of such an attack, to administer a stimulating emetic. The action of vomiting not only relieves, by emptying the stomach, but appears also to have some beneficial action locally. In fact, individuals subject to such attacks, and who have adopted such a course of treatment, have expressed themselves satisfied, that suppurative mischief has been warded off, by recourse to an emetic in the very earliest stage of a sore throat.

As the attack is usually of a very debilitating character, an emetic of mustard is preferable, on every account, to one of antimony or ipecacuanha. Fomentations to the throat externally, inhalations of the steam of hot water pretty constantly, and a free purgation after the action of the emetic, should

be the chief points of treatment. We strongly condemn, *as dangerous*, in every sense of the word, the abstraction of blood, either locally or generally, either by leeches or by any other means. Life may be sacrificed by recourse to such treatment. Blisters appear equally unnecessary, though perhaps not equally prejudicial in their consequences. Mustard poultices appear to afford much relief in many cases; their application is often grateful to the patient's feelings; and by repeated application they can be made to keep up sufficient counter-irritation, without the inconvenience of producing a sore place; whereas a blister is a worrying annoyance to one who has already very great discomforts to put up with; and the subsequent discharge is a considerable nuisance, as it runs down and soils the linen, and stiffens the bed-clothes into which it soaks. Moreover, a blister often abstracts a large quantity of serum, and occasionally leaves a very red, irritable, and painful sore on the neck, which, added to the exhaustion following an attack of quinsey, is by no means advantageous.

This disorder is one that calls much upon the strength and vital powers of the patient. During the greater part of the attack, food is taken but sparingly, and that in a fluid form. It therefore behoves us to husband the forces, rather than diminish them by heroic treatment. As there is much difficulty in swallowing, the less a patient is pestered with physic the more comfortable will be his day. At night it may be desirable to procure sleep, if he be restless; and for such a purpose a few drops of morphia will in all probability suffice.

So much is the patient reduced by such an attack, that when the pus is evacuated by puncture, or escapes by an ulcerated opening, it will generally be found that some days of nutritious feeding are requisite, before he regains the strength he possessed and the substance he carried previous to his illness.

Internal local treatment is more open to discussion. Some writers advocate the free application of the solid nitrate of silver to the surface of the inflamed membrane; but it is somewhat doubtful what amount of benefit is secured by this method of treatment. It is certainly attended with one disadvantage; it produces a good deal of local discomfort, and leaves a most nauseous taste for some time in the mouth, and gives rise to constant hawking and spitting, until the superficial epithelial sloughs, occasioned by its application, are released or removed from the inflamed membrane. We are not aware that the application, under the acute conditions we have described, is followed by any satisfactory or beneficial results.

If the swelling of the tonsil be considerable, the surface very red, and the part very tender, and yet no very distinct indication of pus be present, it may appear sometimes advisable to make a deep puncture into the part to relieve congestion; or one or two incisions less deep. But as a rule, if the urgency of the symptoms be not great, it is far better to wait the formation of matter, rather than experimentally adopt an exploratory use of the scalpel. Every sensible practitioner studies the feelings of his patient; every good Surgeon avoids the uncertain or unnecessary use of the knife. Incisions, if made, often occasion much suffering,—are especially dreaded by some who have previously submitted to such treatment,—and seldom appear to hasten the escape of matter. When, however, pus is detected or suspected, the part should without loss of time be punctured with a knife.

There are some few precautions requisite, in the use of any pointed or cutting instrument, to open an abscess at the back or side of the mouth. The knife itself need only have, from its extremity, a cutting surface of about half an inch. Whatever knife be employed, it is best to protect the blade so as to cover its cutting edge up to this extent, by wrapping round it, from the handle towards the point, a piece of rag or plaster. A sharp-pointed straight bistoury is of all knives the most convenient for the Surgeon's purpose.

In passing the instrument, when protected as described, into, or on withdrawing it from the mouth, the risk of wounding the lips or tongue is necessarily lessened—we may say is avoided; for no such accident should occur in proper hands. On puncturing the tonsil or abscess, an important precaution

must be observed. The point of the knife must be kept turned towards the median line, especially after its point is buried in the soft tissues, and out of sight; on no account is the direction of the wound or thrust of the knife to be outwards. By due attention to this simple caution, all danger of wounding the larger vessels, lying on the outer side of the neck, is certainly avoided.

The patient's head should be fixed, either against the back of a chair, or by the hands of a third person. A sudden movement while the knife is passing into the tonsil, might lead to grave mischief, as the instrument might, accidentally and unavoidably, be thrust in the wrong direction.

The mouth is occasionally opened with some difficulty; and the tongue may be so much implicated in the inflammation that the patient cannot, by his own efforts, sufficiently aid the Surgeon to obtain a good view of the swollen tonsil. Under such circumstances, a broad spatula gently applied to the surface of the tongue, will expose the part sufficiently to permit the abscess to be punctured in a satisfactory manner.*

As soon as the abscess has been punctured, the pus generally flows freely on the withdrawal of the knife; sometimes so abundantly and so suddenly that it runs into the gullet; and from this circumstance, or from the fact that it is often very fetid, it greatly nauseates the patient, sometimes to vomiting. Shortly after the escape of the pus, the patient usually becomes comfortable, expresses himself wonderfully relieved, and soon desires to partake of food. Convalescence is usually rapid and satisfactory.

As we have already said, occasionally, but rarely, the opposite tonsil becomes inflamed and suppurates. Under such circumstances an early tonic and stimulating course of treatment may be requisite; and the medical attendant must look, for his guide, to those symptoms which would indicate constitutional deterioration and physical exhaustion, to be met by generous diet and wine, or other stimulants.

In the treatment of all cases of cynanche tonsillaris, there must be a certain amount of anxiety; but the anxiety as to the symptoms which precede the formation of the abscess, is as nothing compared to the anxiety we may have to encounter, when unfavourable symptoms are set up *after* the evacuation of the pus. In an unhealthy constitution ulceration may supervene upon the incision, and be followed by sloughing sore-throat; or œdema of the surrounding soft tissues may arise, and, travelling downwards around the larynx, pharynx, and œsophagus, terminate the patient's life in a few days. But fortunately these are the rarer evils following upon the evacuation of pus, the result of simple acute inflammation of a tonsil, or true quinsey; the usual history of which complaint is, that directly the abscess has burst or is opened, convalescence is perfect and speedy.

The sore-throat of childhood is rarely acute inflammation of the tonsil ending in abscess. It is usually the symptom or accompaniment of scarlet fever, or partakes of that more frightful and fatal character known as "putrid" or "sloughing sore-throat," of which we shall hereafter speak. The latter is usually accompanied by

* A practical hint in passing may here be thrown out, on the best method of examining the throat generally. With many patients it is often a matter of some difficulty to gain a sight of the fauces. The tongue is pushed upwards directly the mouth is opened; and when the spatula is applied with the intention of pushing down the tongue, the patient immediately appears to resist its application with a steady and firm effort. *If, however, the spatula is, without the slightest weight, laid on the tongue, it gradually appears to contract and is drawn backwards, and the fauces are exposed to full view.* No force or pressure is requisite on the part of the Surgeon to effect this; the weight alone of the spatula appears sufficient to insure the object desired. This experiment has been constantly illustrated, on patients suffering from throat-affections, to our pupils.

enlargement of some of the glands of the throat or parotid. In quincy the throat-glands are seldom affected, and if affected, not to any extent.

Several of the symptoms referred to above, as indicative of the formation of pus in an inflamed tonsil, are present, to some extent, under conditions that are apt to be mistaken for quincy.

A decayed tooth, or a broken stump, will often set up a considerable degree of alveolar inflammation, and be followed by an abscess of the gum or corresponding maxillary region. This condition occasions much difficulty in opening the mouth; the breath is fetid; the tongue becomes very foul and loaded; there is great difficulty in deglutition, and pain of face on the side affected. But generally one marked difference exists between the symptoms of quincy, and an abscess originating in alveolar inflammation; when a tooth or a stump is the cause of the mischief, there is always more or less swelling of the *face*, and tenderness and swelling especially over the *maxilla* affected. In quincy, if there be external swelling present, it is not over the face or cheek; it is confined to the sub-maxillary region, and near the parotid.

In all cases of inflammation, either within or external to the mouth or throat, the medical attendant should look with suspicious care to the condition of the teeth. There are few circumstances in practice more apt to be overlooked, than the evils which arise from the irritation of decayed teeth.

2. *Chronic inflammation*, terminating in enlargement of the tonsil and thickening of its mucous surface, is a very common condition; more especially to be observed in children, and in young persons of both sexes under the ages of from twenty to thirty. The tendency to this form of diseased action, and enlargement, is mostly observed in individuals of a strumous or lymphatic habit. The enlargement frequently commences as early as the second year of life, and is especially liable to occur thus early in children weaned when very young, or brought up by hand-feeding. Less frequently, it does not show itself until towards the period of approaching puberty. It has a tendency to affect females in a greater proportion than males, though it is by no means an infrequent complaint in the latter sex.

The commencement of chronic enlargement of the tonsils appears to be unattended by any marked symptoms, local or general. Rarely is attention drawn to the condition of the part until either the thickness of the articulation, or loud snoring in sleep, excites the

mother's curiosity, or gives rise to anxiety, when an examination of the throat is instituted. Pain is never a symptom attendant on these swellings. The only local symptoms are those which necessarily arise from the mechanical encroachment of the tonsils, in the median line, betwixt the external oral and nasal apertures, and the internal apertures of the breath- and food-passages. The intensity of these symptoms will depend on the size of the masses on either side of the fauces.

The causes which produce this chronic enlargement of the tonsils are not satisfactorily established. A careful inquiry into the history of a large number of cases has failed to detect any one specific reason to account for this diseased action. It does not appear to depend on cold, or insufficient nourishment, nor on want of cleanliness; for it will be met with in the children of the upper, as often as in those of the lower classes, and as often in those who are well provided and tenderly cared for, as in those who are the children "of sorrow and acquainted with grief."

This diseased action does, however, appear to affect in a larger proportion those children who have been brought up by hand or early weaned, than those who have been supplied for a sufficient time with the mother's breast-milk. The enlargement of the tonsils will also frequently commence, on the convalescence from severe attacks of the various eruptive or other forms of fever. Most frequently, however, their growth is grafted on a strumous diathesis.

The forms under which enlarged tonsils occur deserve some attention. One of the most frequent appears to be a uniform globular projection on either side, to a greater or less extent. In this condition the swelling may cease to grow and remain stationary for years, without inconvenience or injurious consequences. Or the glands may slowly and steadily increase in size, until their surfaces touch below in the median space and above either side of the uvula. In other instances, the tonsils appear to enlarge towards the soft palate, and often upwards past its free border, as well as downwards so low, that the lower end is hid from view by the base of the tongue, and is only with care detected when the latter is well depressed; or the tonsil on one side only may be seen to project, a perfectly round mass, which is attached to the fauces by a thin pedicle of mucous membrane: occasionally an outgrowth has been seen, a pendulous tumour hanging from the natural position of the tonsil.

The surface of an enlarged tonsil is generally somewhat uneven, often very much pitted; the mucous membrane thick and velvety, and seldom without an increased vascularity. In many instances all these conditions may be observed in an aggravated degree. Often, superficially ulcerated spots are seen dotting the surface of the swelling; or, what is more common, small points of thick sticky sebaceous secretion will be observed, marking the orifices of some of the ducts which lead into the substance of the gland-tissue.

The fauces, especially when the enlargement of the tonsils is considerable, may often be seen covered with a viscid yellowish semipurulent secretion; this clings to the posterior surface of the glands, or lines the walls of the upper portions of the pharynx.

When the enlarged gland projects to any extent above the soft palate, some degree of deafness is occasionally complained of. This concomitant symptom appears to depend rather upon the thickened condition of the mucous membrane, which, extending from the tonsils, runs up to, and may line, the Eustachian tube, than upon any actual encroachment of the gland on the orifice of the tube.

Enlarged tonsils appear to be the result, not the cause, of constitutional derangement, provided they do not become large, or

encroach much on the isthmus of the fauces. But if they increase in size, and much lessen the passage from the mouth to the pharynx, many unpleasant effects may be detected. The voice is generally somewhat unnatural and muffled, and the pronunciation thick. So that enlarged tonsils appear to be a perfect impediment to the production of fine sweet notes in song, or clear sonorous tones in speech. The breath is often offensive; partly rendered so by the decomposing sebaceous secretion sticking in the orifices of the glands, partly by the thick semipurulent mucus which clings to the fauces.

The enlarged glands are constantly liable to attacks of ulceration, and sometimes to acute inflammation attended by fever. If large in children, they produce more general effects on the system than in adults. They now interfere with perfect and free respiration. At night the child snores loudly; often awakes in his sleep, and as often in a state of alarm. In some instances the natural and requisite amount of rest is so interfered with that the child's health suffers. There is also frequently some little inconvenience in swallowing, and care is observed to be taken by the child that only small quantities of food be swallowed at a time.

If a section of a portion of an enlarged tonsil be examined carefully, it will be found, to the touch, firm in consistence, and somewhat elastic when pressed. The face of the cut surface will present several small cup-shaped depressions, from which may be picked, every here and there, or squeezed out, small collections of sebaceous matter. The structure of the enlarged mass consists of condensed areolar tissue, which often runs like bands between and around the depressions above alluded to. The naturally soft structure of the gland is so condensed and firm, that it assumes the character of fibrous tissue intersecting the substance of the growth in every direction.

The accumulation of epithelial secretion within the ducts of the glands, occasioned by the obstruction of their orifices, is the explanation of the formation of the cup-like depressions seen on a section of the gland: for as the secretion increases, and cannot escape through the obstructed orifices of the ducts, it collects in the latter, dilates them, and sets up chronic inflammation of the structure of the gland itself, which terminates in its permanent enlargement.*

The treatment of enlarged tonsils may be summed up in a few lines. Unless the voice be affected to such an extent that it becomes desirable to lessen or remove them; unless the disturbance to the sleep of the child be manifestly interfering with health; unless the breath be rendered fetid or offensive by the secretion from the ducts; or unless some other cogent reason render it desirable to interfere with the mass,—it is better to leave the tonsil in its

* Kölliker has given a minute account of the pathological conditions of the tonsil, and the abnormal secretion of the gland under such changes; but as any transcript of his investigations would not add to the practical importance of this subject, we beg to refer those interested in the question to the original, *Manual of Human Histology*, vol. ii. p. 30,—Sydenham Society.

slightly enlarged condition, without the application of any local or constitutional measures. If a child so affected be delicate, and the tonsils appear increasing, we prefer constitutional to all local treatment short of that of removal. In the early stages of enlarging tonsils, if detected, it would be best to administer tonics as a rule, as they certainly act beneficially as regards the health; and by so doing, as far as experience allows us to hazard an opinion, arrest the progress of the growth. At any rate, under a tonic treatment such enlargements frequently remain stationary. Steel-wine, muriated tincture of iron, citrate of iron, syrup of iodide of iron, and cod-liver oil, each according to the constitutional peculiarity, may be prescribed with safety, and taken with evident benefit for many weeks or months. We need hardly caution the reader on the importance of attention to diet; and with very weakly children, sea-bathing is of the utmost advantage.

Local applications are frequently recommended, and too constantly adopted. Nitrate of silver rubbed over the surface, or points of nitrate of silver run into the substance of the gland; sometimes nitric acid carefully applied to portions of it; stimulating gargles; and a variety of troublesome and useless applications, have had their advocates for the arrest or removal of these masses. But an examination of a portion of a gland removed by excision will show such structural changes, such a fibrous thickening of the finer areolar tissue, that it appears to the author a useless waste of time and material to attempt to procure absorption of such dense tissues. Nothing short of an actual slough can do good, if caustic be used; no stimulating application can offer much hope of acting on such a structure; we therefore never use any, as we trust to none of these local measures. If constitutional treatment does not arrest, and local treatment be requisite, removal by the knife of a portion of the gland is the speediest, and, in our opinion, the only efficient remedy. The Surgeon with a knife can remove all that is necessary in a few seconds; and the patient will be entirely rid of the consequences within a week after.

When the glands are so large that some portion must be removed, to relieve the symptoms of discomfort or distress from which the patient suffers, the operation is simple enough in adults; but may be somewhat troublesome when necessary in a young child.

It will be found advantageous to place the child sufficiently under the influence of chloroform, so as to allow of the mouth being easily kept open. The tongue being then depressed, a portion of the gland may be seized with the vulsellum, and rapidly cut off with a blunt-pointed straight bistoury, the cutting edge of which should only be exposed, near the point, to the extent of an inch. If, on the other hand, chloroform is objectionable, the mouth must be forcibly held open, the tongue gently and firmly depressed, and a portion of the gland removed, either with the guillotine or the knife.

In the adult, there is no difficulty in the operation such as may be encountered in children. The gland can be at once seized with the vulsellum, and a portion rapidly cut off with the knife. If both tonsils be enlarged, and this is usually the case, there is no objection to a portion of each being removed on the same day. With children it is preferable to do so, as the fear of an operation is much greater when the child has had any experience of a previous one; and therefore to make the attempt to remove a portion of the second tonsil on a subsequent day, is much more likely to increase the difficulties of the operation from the struggles of the child, than if the operation on both tonsils be at once got over. But in an adult it may be left to the

discretion or wishes of the patient, whether the operation be completed at once, or at a subsequent period. If the tonsils are very large, it is always advisable to take away a considerable portion of each. But it is by no means requisite to remove the whole of the projecting mass. If half of the surface be removed, and the cells thus laid well open, what with their becoming emptied, the relief occasioned by the incision through parts chronically inflamed, and the subsequent contraction of the cut surface by cicatrisation, the portion that is left shrinks and sinks into the side of the fauces, to give no further trouble to the patient.

After the removal of the mass, the patient generally suffers but little ; or rather as one affected with slight sore-throat. The precaution to be given is, to use soft food, and to avoid exposure to cold for a few days, when the cut surface will be about healed. Hæmorrhage rarely follows to any troublesome extent on this operation ; but it may, and sometimes does occur. The Surgeon, always anxious to avoid such a contingency, should take the precaution, when operating, to draw as much of the gland as he conveniently can, well into the cavity of the mouth inwards and forwards, so that a large portion may be seen projecting from the attached base ; not more than half of the mass need be removed, and even as much as this only when the tumour is of considerable size. Such a portion will always be found sufficient for the ultimate relief of the patient, and the removal of all the previous disagreeable symptoms. In the practice of the author, such a proceeding has never been followed by troublesome hæmorrhage. Should hæmorrhage occur, iced water as a drink, or the mouth kept open for a time, may control it ; or digital pressure may be requisite.

In children, hæmorrhage may be suspected only after it has continued some time, from the cheeks becoming pallid, and the little patient showing signs of faintness. If, on examination, any distinct vessel is seen to bleed, a ligature can be applied with a little care ; or recourse must be had to pressure, if the bleeding is from the general surface.

We need only refer to the proposal to remove enlarged tonsils by the application of ligatures, to condemn the plan of treatment as tedious, painful, and productive of much offensive discharge, until the slough separates.

3. *Tonsillitis maligna.* Ulceration of an acute form attacking the tonsils, and rapidly running into sloughing of the fauces, is a very grave—often a most intractable—affection ; and as rapid as it is unmanageable.

Sore-throat is the first symptom complained of, and with it the patient probably expresses himself as feeling ill. Rigors, followed by feverish disturbance, will generally supervene. The tonsils will soon be observed of a dusky-red colour, and swollen ; and the surrounding soft tissues and uvula are already cedematous. There will generally be much pain, and some difficulty in deglutition. Patchy shreds of gray or yellowish membrane appear imbedded in the surface of the tonsils. These, after a time, spread, unite, and become deeper, until a considerable portion, if not the whole, of the soft palate may become implicated in the spreading mischief. The discharge which accompanies this form of slough escapes freely from the nose ; for as the havoc spreads, the passage of even fluids to the throat is rendered difficult, and is often entirely intercepted by the cedematous state of the cellular tissue below the root of the tongue

—so that liquids taken by the mouth are rejected through the nostrils. The character of the discharge is usually most offensive and intolerable. The room has to be kept well aired, and a constant and liberal use made of solutions of chloride of soda or lime, to moderate the fetor occasioned by the discharge.

If the patient survives, large sloughs separate from the parts attacked, and a considerable granulating surface may soon be observed, marking the havoc of the disease that has passed. In this havoc the whole of the uvula, and a considerable portion of the soft palate, have been seen to disappear, the patient's health being subsequently perfectly restored; though there remain for life the permanent defect, the alteration of the voice, and the inability to articulate distinctly,—the result of the local injury to the soft palate.

In the greater portion of severe cases of malignant sore-throat, the probability is, that they are specific, or only a type of the severer forms of scarlet fever. But still the Surgeon's experience may be sometimes advantageously referred to in some of the stages of such cases; for which reason we have taken a brief notice of them.

As in sloughing of other tissues, so in that of the throat, under all circumstances a stimulating and tonic treatment must be pursued; wine must be freely given; and with children, the muriated tincture of iron in full doses may be most advantageously administered. It is most efficacious as a tonic in such cases; can be given in small bulk; and, with the addition of a little syrup, forms a mixture that children do not object to—a desideratum of no small importance in their management when sick.

A superficial and less severe form of ulceration of the tonsils is a very common occurrence. "Ulcerated sore-throat" is a term so familiar, and a condition so well understood among the more industrious, and often over-worked students of our hospitals and dissecting-rooms, that it requires but little description here. Pain and some difficulty in swallowing; a creamy tongue; soft, weak pulse; pallid face; loss of appetite, and often loss of sleep; much languor and pains in the limbs; tonsils congested, and somewhat swollen; small irritable, superficial, and scattered ulcers on the fauces and tonsils: such are the chief symptoms found to accompany one of these attacks.

The treatment is well understood. Change of air; a stimulating gargle; a slight aperient if requisite (mercurials, however, to be generally avoided); the internal administration of bark and ammonia, or chlorate of potash; and a nutritious fluid diet, with a few glasses of wine daily. Convalescence is generally satisfactory under such treatment. In all of the more acute inflammatory and ulcerative actions affecting the throat and tonsils, the internal administration of chlorate of potash, as well as its free use as a wash or gargle to the part, appears to be attended with marked benefit. A lotion of the permanganate of potash is also most agreeable in such cases; for, as a gargle, it leaves a very pleasant taste in the mouth, and rapidly renders inodorous

offensive discharges. It may with safety be used largely as a gargle, or wash in all throat affections.

“Relaxed uvula” is by no means an uncommon complaint. The term does not quite describe the actual state of the parts in their altered conditions; for the uvula may be thickened and not increased in length. Under such circumstances it occasions but little annoyance, and seldom requires attention. Or it may be lengthened without being thickened, and this is the most common evil; and then surgical interference is necessary.

The increase of size, or the elongation, appear to be as independent of the condition spoken of under the name of enlarged tonsil, as the two conditions are of each other.

The increase of size is usually accompanied by a thickened state of the mucous membrane, and often a slight tenderness of the part. Though the thickening may remain, the tenderness after a time will subside; and then the part is left in a permanently enlarged, though not in a persistently enlarging, condition. It seldom increases to an inconvenient size.

Should the symptoms which attend the first increase of size be troublesome, the simplest local remedy is to smear the surface once or twice with the solid nitrate of silver; and constitutionally use such measures, as the general condition of the patient will indicate to the observant practitioner. Usually the condition is one which is benefited by tonics. Elongation of the uvula appears to be generally dependent on an excess of mucous membrane; for the azygos uvulæ muscle does not often form any part of the increased growth. The mucous membrane may extend an inch beyond the extremity of the muscle, and hang down like a thin narrow slip of tissue, ending often in a point. When of this length, it dips into the pharynx, and the point rests over the aperture of the larynx. This contact with the larynx keeps up a constant source of irritation, and occasions a troublesome cough. Frequently the tickling of the fauces and pharynx produces nausea and a tendency to vomit. Patients sometimes, after food, on coughing, reject a portion of the meal taken. These symptoms are often attributed to other causes, until the throat is examined and the condition of the part detected.

This elongation of the uvula is not often seen in children, but most frequently in the period of middle-life. It is seldom observed in old age.

The treatment is as simple as the relief is certain. Removal by knife or scissors is the only treatment to be entertained for a moment. The point of the uvula is to be seized with a long pair of forceps, and cut off so near to the base as to leave the part of its natural length.

The patient may feel the throat a little sore for a day or two, but no treatment beyond ordinary care will be requisite. The uvula is very apt to be implicated in inflammation about its neighbourhood; and constantly, under such circumstances, becomes oedematous. This condition, however, is seldom confined to the uvula alone, but implicates usually the soft palate and adjacent tissues. It depends on erysipelatous or diffuse inflammation of the cellular tissue—a dangerous and often fatal affection, which has been spoken of in the essay on DISEASES OF THE LARYNX, vol. iii. p. 228.

Tumours of the soft palate and fauces are sometimes met with of a non-malignant character, and independent of inflammation. These usually consist of, 1. Fibro-cellular tissue; 2. Cysts.

1. The small fibro-cellular tumours usually assume a pendulous character. They are painless ; usually attached to the free border or upper surface of the soft palate ; and are generally only detected, when they become locally inconvenient by dropping down below and behind the root of the tongue. They are usually somewhat slow in their growth, and as they increase in size become more pendulous, often supported by quite a thin pedicle. They can be readily removed with scissors and forceps.

2. *Cysts* of these parts commonly contain thin glairy fluid, generally the result of obstructed muciparous ducts. They are readily treated by a simple free incision, and a subsequent application of solid nitrate of silver, or a drop or two of nitric acid, applied on a probe to the interior of the cyst.

Sebaceous cysts are occasionally found in the substance of the soft palate. They may be recognised by their yellowish white colour showing through the mucous membrane. They only require to be laid open, and the interior of the cyst touched for a day or two with a probe dipped in nitric acid.

Abscess of the soft palate is rare ; but it should be opened as soon as detected. It generally gives no subsequent trouble.

CONGENITAL FISSURE—" CLEFT PALATE"—AND DEFECTS OF THE PALATE FROM DISEASE OR ACCIDENT.

Congenital fissure of the palate is so frequent an occurrence ; the evils which result from it are so marked ; and even life itself, in infancy, is so often endangered and not unfrequently cut short, when the fissure is extensive,—that a consideration of the treatment which proposes to overcome or to modify the defect, may truly be said to form a subject worthy of notice in a work on Practical Surgery.

The investigation of the early development of the mouth, explains the various degrees of extent that congenital fissure of the palate *may* assume, and such as *are* constantly found to exist in the new-born infant.

To Mr. Goodsir* the profession is deeply indebted for an accurate account of the development of the mouth ; and although, in a practical work of this character, it would be intrusive to enter very fully into such a subject, we are compelled to take a cursory view of the changes which occur in the upper jaw *in utero*, in order to clear up to a certain extent the causes of the variations met with in these deformities.

In a foetus of about the sixth week, examined by Mr. Goodsir, the cavity of the mouth, nares, and pharynx formed one undivided space ; the palate was entirely wanting ; the outline of the future alveolar ridge was evident. With the particular description of this latter process we need not trouble the reader ; but from the inner margin " a thin semi-transparent membranous fold passed backwards on each side, attached externally to the sides of the capacious

* *Edinburgh Med. and Surg. Journal*, vol. li. p. 1.

bucco-pharyngeal cavity, bounded internally by a free edge, opposed to its fellow of the opposite side, and terminating posteriorly on the lateral walls of the pharynx.

"These folds constituted, at this period, a partial division of the large common nasal, buccal, and pharyngeal cavity into a superior and inferior compartment.

"The upper wall of this common cavity was smooth and flat posteriorly; but anteriorly it was contracted, and terminated in a longitudinal bar (the future septum nasi), which ran forwards to be attached to the superior surface of a horse-shoe lobe* (described) at the median line (in front) and to the other parts in that neighbourhood.

"Under the bar a deep cavity was seen, which communicated with the exterior of the face by two small foramina (the orifices of the nostrils), which constituted at this period the whole external nasal organ."

In an embryo of about the seventh week, next examined, "the cleft had slightly diminished, but was still of sufficient width to display the whole of the undivided nasal cavity."

In an embryo of the second month "the cleft of the palate had diminished, existing only as a small angular deficiency in the pendulous portion, or soft palate."

In an embryo of the tenth week, the anterior portion of the palate "had thrown itself into folds; and there was an indistinct uvula."

The uvula "was well marked between the eleventh and twelfth weeks."

If an examination be made of the bones of the palate previous to, or not later than, the sixth month of foetal life, in addition to the median suture between the palate-processes of the superior maxillary bones, a distinct oblique suture will be observed, which starts from the median suture a little behind the alveolar ridge, runs outwards and forwards through it, and terminates on its anterior aspect, at the point subsequently marked by the interval between the lateral incisors and canine teeth. So that in fact the under or palate-surface of the superior maxilla is at this period of life (third to fifth month) marked by this suture, as if the bone had been at an earlier period divided into two portions: one, an anterior small "intermaxillary bone," or "os incisivum," as it is termed, and which carries the incisor teeth; and a posterior, the larger portion, in the alveolar process of which are developed the canine, bicuspid, and molars. This suture disappears, under healthy natural development, soon after, or even before, birth.

If we compare the various stages of the development of the palate with the numerous deformities which affect it, we may distinctly trace the latter, step by step, as due to the arrest of that development in the upper jaw and velum; and may class them thus:

1. The most extensive, a double cleft of the alveolus;† a fissure running on either side of the median line, in the course of the lateral sutures already described, unites with the opposite one, and opens into an entire cleft of the hard and soft palate.

2. A single cleft of the alveolus, on one side or the other of the median line; running back and into an entire cleft of the hard and of the soft palate.‡

* This may be taken as the future "os incisivum" or intermaxillary bone.

† The cleft of the alveolus under such circumstances is often complete throughout from front to back, and from the mouth into the nostril.

‡ Instead of the alveolar ridge being cleft, as described, in this variety, there may be only a notch, or a large or small foramen through its base. The cleft has been partially closed by growth, or pressure of the lip.

3. The alveolus entire; the cleft of the palate complete from that process backwards.

4. The cleft running as far forwards as the middle of the palate-processes of the superior maxillæ, or through the palate-bones only.

5. Fissure of the whole of the soft palate, or only implicating the uvula.

Between the extreme of one and the other every gradation of extent may occur.

Occasionally, but rarely, a congenital defect is met with in the median line, either as a circular or oblong opening: in front and behind it the palate is closed. These openings most frequently occur in the palate-bone; and usually, when such an opening exists, the median line of union is very plainly marked on the under surface of the soft palate and the uvula, by a distinct straight thin cicatrix, showing the union of the sides of the soft palate completed, although the palate-bones, in consequence of their defective development, were unable to perfect the naso-oral septum in their immediate neighbourhood.

It will be observed in some cases that the gaps through the alveolar ridge are excessive, *i. e.* complete from mouth to nostril; while in other cases they are but partial. When excessive, and when the fissure is complete through the hard and soft palate, the intermaxillary bone, or "*os incisivum*," becomes often widely separated from the superior maxillæ, and forms a nodule more or less round (the horseshoe lobe of foetal life, already described), which is supported by and attached to the anterior inferior termination of the septum nasi. This nodule may be more or less prominent, and is occasionally so much so that it appears simply to be stuck on to the tip of the nose. Under these circumstances it is but little covered with skin, which is merely a prolongation from the integument on the apex of the nose, and unconnected with the integument of the lip on either side.

If the nodule be dissected between the sixth and eighth month after birth, in it will be found not only the temporary incisors, but also the germs of the permanent ones; not always the lateral, but invariably those of the central incisors. Occasionally those of the lateral will be found, though they frequently are sacrificed by the freak played by nature in permitting these gaps to occur.* Whenever a single fissure occurs through the alveolus, the gap will not be found in the median line, but, as a rule, on one side or other of it. We cannot satisfactorily explain this. It may depend on the peculiar conformation of the upper jaw and its early development. We would refer those interested in the subject to the further consideration of Mr. Goodsir's observations.

It is rare indeed that the infant born with extensive cleft palate and

* When this nodule is very prominent, and appears likely to interfere with the success of an operation for the closure of hare-lip, we would strongly urge the importance of depressing it forcibly rather than removing any portion, or the whole of it. It may be forcibly broken and depressed, and made to fit in the gap between the superior maxillæ, where it will invariably become firmly fixed, and subsequently have shooting out from it some or all of the incisors. If these be defective, the surface of the bone forms an excellent rest for a plate to carry artificial teeth. If the *os incisivum* be removed, the superior maxillæ are certain to be more or less drawn together by the action of the upper lip, the upper portion of the mouth much narrowed, and the gap never entirely closed.

alveolus has not also the upper lip notched or fissured opposite to the defect in the bone. Usually, if not invariably, when the cleft of the alveolus is double, the cleft of the lip will correspond; when single, the lip is usually similarly affected. But when the cleft of the alveolus without cleft of the palate occurs, hare-lip is not always present.

In complete cleft of the roof the attachment or disposition of the septum nasi varies in different cases. As a rule, the more extensive the gap, the greater the deformity. The septum will often be seen, in complete cleft of the palate, to be continuous by its lower border with the margin of one or other of the edges of the cleft; in which case one of the nasal cavities is so far shut off from the mouth, while the other is open to it. In other instances the septum dips down between the nasal fossæ almost as low as the edges of the fissure, and terminates in a free defined border, unconnected with the superior maxillæ; or it will be sometimes seen bent or folded on itself, its edge turned up to one side, with one of its lateral surfaces facing downwards.

These different conditions of the septum have no practical bearing on the subsequent treatment of the case. Rokitsansky alludes to fissures of the palate caused by the absence of the os incisivum, and attended by fissure of the upper lip *in the median line*;* but he does not state that he had met with an example of this rare deformity. Mr. Fergusson,† in alluding to the occurrence of cleft in the lip, says: "Doubtless it has been named hare-lip from a certain resemblance to the fissure in the upper lip of the hare; but in the human subject it differs in this peculiar feature, that it never is in the mesial line, as it always is in the hare."

Rokitsansky only alludes to the occurrence of the fissure in the median line, but gives no details of any peculiarities which might be supposed to accompany such a defect. Mr. Fergusson has apparently not met with a case; and the deformity is no doubt most rare. But a specimen such as Rokitsansky refers to—the result of absence of the os incisivum and fissure in the median line of the upper lip—may be seen in the Museum of the Royal College of Surgeons in London. In the preparation alluded to (of which no history is recorded), the fissure of the upper lip is in the mesial line, the result of a great gap, as if a large portion of the middle of the lip were destroyed; the os incisivum is altogether deficient, no vestige of it being present; and the cleft of the hard and soft palate is complete.

But there is this additional interesting feature in this remarkable specimen: the anterior nasal apertures are wanting. The explanation of this latter defect appears to be simple. The os incisivum being absent, the septum nasi has nothing to attach itself to in front and below. The anterior orifices of the nostrils are therefore defective; the apex of the nose does not project; the alæ are flattened; and as the *entire* floor of the nares is deficient, and the anterior lower portion of the septum terminates by a free edge, the would-be-anterior orifices of the nostrils are merged in the median gap of the lip, alveolar ridge, and mouth. This interesting and very rare specimen had not (1863) been accurately described in the Catalogue; but through the kindness of Mr. Flower, the Conservator of the Museum, the author was permitted to examine it, when the particulars described were verified. Probably the child was still-born, or died soon after birth.

We do not attempt to enter into any explanation of the causes of cleft palate. We possess no data to justify the pretence that observation has thrown any light on the subject. The evil, when it occurs, may be reasonably ascribed to arrest of development at some period of foetal life prior to the fourth month. But the cause of that arrest is shrouded in mystery, and is one of those caprices of nature to account for which is entirely beyond our ken.

* Rokitsansky, *Pathological Anatomy*, vol. ii. p. 3.

† *Practical Surgery*, p. 584.

Thus much, however, we may state, that in the isolation of the os incisivum from the superior maxillæ, we find an approach to a somewhat similar arrangement in the teeth of the upper jaws of certain animals, in whom the incisors are separated, by a distinct interval or gap, from the bicuspid or lateral teeth.

Cleft palate and cleft lip are frequently found to affect more than one member in a family; but we cannot at all state that congenital cleft of the mouth or lip is a common occurrence, as a result of hereditary transmission. It is rare to observe both the parent and offspring affected on either side, although brothers and sisters of the same family constantly present different conditions of the deformity.*

Practically, the more extensive the cleft in the palate, the wider it will generally be found, and the more upright will be the surfaces forming the sides of the gap. Usually the cleft in the palate is narrower in front, and widens towards the velum. But much variety will be found if a large number of cases are compared with each other. In some the gap will be very wide; in others, though it be complete from alveolus to uvula, the gap will be very narrow. When the cleft is only partial, the less it encroaches upon the hard palate, the more natural will be the arch of the roof in front; and the sides of the partial cleft will also somewhat partake of the natural curve of the arch rather than run upwards, as is almost always the case when the cleft is considerable, or extends entirely through the palate and alveolus. Though the extent of the cleft be restricted to a small portion of the palate-bone and the soft palate, it by no means follows that the cleft is equally narrow in proportion; on the contrary, it will be frequently found that these partial clefts are very broad; so much so in some instances, that the palate-processes of the palate-bones and the sides of the bifid soft palate appear to be almost wanting. These partial clefts have been found to present, in some few instances, the greatest breadth met with; even to such an extent, in one or two instances, that operative interference was considered unjustifiable, as there did not appear, even of the soft palate, sufficient tissue to allow of the edges being brought together by suture.

The primary effects of cleft palate, when extensive, are suf-

* How far civilisation or crowded populations may influence congenital deficiencies in the human subject, is a question to be hereafter worked out; but it is a curious fact, that most of the young of the lions, caged in the Zoological Gardens of London, are born with defective palates, and consequently die soon after birth. As far as our limited means have enabled us to ascertain, it appears that it is not usual for the lion family, in a state of confinement, to have their young similarly affected, but that this congenital defect is restricted to the lions kept in the Regent's Park, as if some local influence were instrumental to this end.

ficient to create much necessary alarm for the safety of the infant's life. If hare-lip exist, with double or single cleft of alveolus, and a broad cleft of the roof, unless the infant be supplied *plentifully* with its mother's milk from the first, it will probably soon sink from exhaustion. It is very difficult in such cases to introduce a sufficient quantity of milk into the stomach, to insure an amount of nutrition equal to the maintenance of life. The mother's milk is the only food that should be given for the first six or eight weeks. In all cases of cleft palate, the infant is unable to suck the nipple: for as the naso-buccal septum is wanting, the child cannot form, with its tongue, a vacuum in the mouth; nor is it able to draw the ducts of the mammary gland. It therefore becomes compulsory to hand-feed such an infant. For several weeks after birth it should be held almost upright when taking the bottle: this position allows the fluid nourishment to flow backwards and downwards into the pharynx, instead of running into the nares and out of the external apertures, as would be the case were the child fed while on its back.

After a few weeks of this careful nursing, the child will begin to take its food with greater facility; and as it grows older, with a freedom which is somewhat surprising when the amount of defect in the palate is considered. But as these children have often a very great struggle for life in the earlier weeks, we repeat that *breast-milk should be alone given*. The milk should be drawn from the mother or nurse, and given with a bottle, to which a smooth flat ivory pipe is attached; its orifice should be small; and the flow of the milk through it so managed that suction is not requisite, but at the same time that the current be gentle, and easily regulated by the inclination of the bottle in the nurse's hand.

So much as regards the early nursing of a child born with cleft palate. It now comes to be a question whether any treatment be requisite to alter, or improve, by surgical interference, the condition of the mouth prior to the age of puberty.

The use of an artificial septum, both for the hard and soft palate, is, in the opinion of the author, very desirable at as early a period as it can be adjusted; and recent experience has proved that its adjustment can be effected most satisfactorily at a comparatively early age. The sooner one can be worn, the less defective will the articulation become, and the more readily will the education of the child be advanced. The plate for the hard palate should be made of thin metal: gold is of course the best; but as the plates must be renewed as the child's mouth increases in size, a heavy cost is thereby entailed on persons of moderate means. Under such circumstances silver or vulcanite may be substituted; but silver becomes readily soiled, and vulcanite occupies more space in the small mouth. The artificial soft palate is attached to the posterior margin of the plate in front, and is made of thin india-rubber sheeting. It is soon worn without inconvenience, and greatly aids the person to speak more distinctly, when comfortably fitted.*

* The author cannot allow the opportunity to pass, without bearing testimony

The age of the patient is a matter of some consideration to the Surgeon who proposes to operate for the permanent closure of a cleft palate. There can be no doubt, as a general rule, that the patient should be old enough to desire the operation; should have sufficient determination to endure it; and should be able to estimate the advantages to be derived from it. For many reasons, the age of fifteen appears to be the earliest period for the operation; often a later period is desirable; though in some few instances it has been performed on younger children.*

When it is recollected that the operation requires every assistance the patient can afford, by determined courage and quiet endurance of pain, by keeping the mouth open even to a tedious and painful extent; that the duration of the operation depends mainly on the tendency of the wounds to bleed; that bleeding is often abundant, and apt to produce fainting; that chloroform is of no assistance, but inconvenient in its administration, and can never be sufficiently given to produce insensibility for the entire period required to complete the operation; when it is known that towards puberty the operation is often resolutely submitted to, even though it may occupy a long time,—the profession may feel satisfied that the use of the artificial plate to the period of puberty, with the option of the operation then, is the treatment which should be adopted by the Surgeon; is a principle which, if followed, will give most satisfactory results; and is a rule in surgery which, in the opinion of the author, should have no exception.

As the most simple form of cleft is that confined to the velum or soft portion, we propose to consider, first, the method to be adopted to close it, irrespective of any extension of the fissure into the hard palate.

Should the uvula alone be bifid, very little is requisite to secure union of its opposed edges; and indeed, if the voice be not affected, nor the cleft detected by any peculiarity in the articulation, it is better not to meddle with the fissure. Cleft of the uvula, however, usually affects articulation. The Surgeon need have no hesitation in undertaking the operation. The opposed edges of the bifid uvula should be pared, care being taken to carry the incisions on either side a little way into the soft substance above, so that they meet in the median line in front of the commencement of the cleft; care must also be taken that the mucous membrane at the edges is sufficiently removed to insure two raw surfaces being adapted to each other. The Surgeon must first seize one point of the bifid uvula with a pair of long spring forceps, and draw it forwards; then transfix its margin with a narrow sharp knife on a long handle, and freely cut upwards and downwards, to enable him to remove the mucous membrane along the entire edge of the whole inner margin. A

to the ingenuity and efficiency with which Mr. Sercombe, Surgeon-Dentist to St. Mary's Hospital, has adapted artificial palates to the mouths of children afflicted with very extensive clefts; with so much success has his practice been attended, that an ultimate operation for the complete closure of the palate becomes a matter of choice rather than one of absolute necessity, for the improvement of the voice, &c.

* In one case operated on by M. Billroth of Zurich, a cleft extending from the lip to the uvula was closed by successive operations before the age of twelve months. See Billroth, in *Langenbeck's Archiv*, vol. ii. p. 657.

similar proceeding on the opposite side completes the use of the knife. A couple of sutures will be sufficient to approximate the edges and keep them in place.

In the experience of the author, fine silk is as efficient for the purpose of sutures as any other material, and is preferable to most. Such sutures are readily introduced, and very readily removed. The latter is not a point of trivial importance, and is an advantage when the soft palate is concerned, which does not apply to metallic substances. The author has invariably used silk sutures in all operations for cleft palate, and with the most satisfactory results; so that in speaking of the sutures in these operations, no further allusion will be made to their material.

When a cleft extends forwards through the whole of the velum, or even to a slight extent into the palate-bones, the operation is rather more complicated than that above described; and though not beset with any difficulties, requires a careful examination into the anatomy of the soft palate, and some little familiarity with the operation, before the Surgeon can be confident of obtaining that success, which should usually follow attempts to close a cleft palate by surgical interference.

That the edges of a wound should meet without any traction on its margins by sutures, is a fundamental rule that applies generally to all plastic operations; but especially is absolute in any operation to close a fissure of the palate, whether in the hard or soft portion.

If a fissure of the soft palate be carefully examined, and with the mouth open the patient make an attempt to swallow, the action of the muscles of the pharynx and tongue is such, that the edges of the fissure are approximated by the action of the superior constrictors; the extremities of the bifid uvula touch, and often the gap is for an instant closed to one-third or one-half of its extent; but immediately afterwards the sections of the soft palate are drawn back to the walls of the fauces; and often the whole of the soft palate itself is so closely contracted into the side of the fauces, that a superficial observer might conclude, in some instances, that no soft palate existed. This latter effect is the result of the combined actions of the levator and tensor palati muscles contracting towards their attached extremities, and thus drawing up the sections of the velum. So that every attempt to bring the edges of the fissure together, would be opposed by these muscles, on either side, pulling away from the median line, and consequently drawing directly away from the line at which the edges of the fissure should meet to insure union.

Having experienced this evil, and at once seizing on the cause of the failure, which then so constantly attended attempts to close the fissures of the soft palate, Mr. Fergusson proposed the division of these muscles prior to the edges being brought together. In a paper published in the *Transactions of the Royal Medical and Chirurgical Society* he fully describes the method he adopted to insure this result. Since Mr. Fergusson promulgated his views, this operation has been commonly undertaken, and, thanks to his suggestion, has been followed by a large share of success. Mr. Fergusson recommends the division of the levator palati on either side, by cutting, with a knife bent at a right angle, behind the curtain of the soft palate. The division of the muscles is thus most effectually secured. He also recommends that the palato-pharyngeus be divided on either side. In able and experienced hands, to cut with the right-angled knife, behind the palate, where the point of the knife is out of sight, is a simple matter; but there are few Surgeons unaccustomed to these operations, who feel at ease in using such a knife in such a situation. Having observed this, it occurred to the author, some few years back, that the levator muscles could be as readily divided by cutting through the palate. An attempt on the dead body at once proved the extreme feasibility and facility of thus dividing these muscles; since which time every case that has come under his care has been thus treated, with the most satisfactory results. The method of procedure is very simple. First a suture is passed through one section of the soft palate at the root of the uvula, the ends secured together by a knot and held outside the mouth. A second suture is then passed through the opposite side at a corresponding point. One of the sutures, now firmly holding one-half of the soft palate, is drawn gently forwards and to its opposite side, so that the section of the palate is well stretched towards the median line. A thin, narrow, sharp-pointed knife, fixed in a long handle, is then introduced into the palate, close to the hamular process, a little in front and to its inner side. This process can be distinctly felt in the substance of the soft palate, internal, and a very little posterior to the last molar tooth. Running the knife upwards and backwards, and somewhat inwards, the point may at last be seen in the gap, having passed through the entire thickness of the soft palate, and having cut, if not wholly, at any rate partially, through the tendon of the tensor palati: the knife should now lie above most of the fibres of the levator. If the handle of the knife be next raised, the point becomes depressed; and if the blade be drawn forward, while it is at the same time made to cut downwards, it travels through a considerable section

of a circle on the posterior surface of the palate, and insures the division of the greater portion of the levator palati. As the knife-blade travels downwards, the tension of the palate gives way, and often the division of the muscle is felt to be suddenly effected; the ligature being no longer pulled upon by it, though previous to division it will be felt sensibly and spasmodically contracting. As the knife is withdrawn through the wound, the division of the levator muscle should be thoroughly effected. The wound, in the front of the palate, need be no more than the width of the knife; whereas the wound behind is necessarily much longer, for the fibres of the levator have there to be divided by the sweep of the knife. Provided the muscle be effectually divided as soon as the knife is withdrawn, it will be found that all voluntary and involuntary movements of the palate have ceased; it has become pendulous and flaccid; pulling on it now should produce no spasmodic contraction of its fibres. Should any resistance still be observed, the knife must be again introduced through the anterior wound, and the fibres a little more freely cut in a downward direction.

The muscles having been divided on both sides, the sutures, used for the purpose of holding the flaps, should be removed, that they may not be in the way of the operator.

The edges of the cleft have next to be pared. The knife already used will answer for this purpose; and there appears this advantage in the above method of operating, that *one knife suffices for the entire operation.*

Great care is requisite to free the edges sufficiently of their mucous covering: it is better to remove a little more than requisite, than an insufficient quantity; for the success of the operation is not interfered with in the former case, whereas the operation will most certainly fail to some extent in the latter condition.

Though Mr. Fergusson recommends the division of the palatopharyngeus muscles, the author has of late satisfactorily operated on several clefts of the soft palate, without having divided those muscles or touched them with the knife.

The completing stages of the operation consist in passing the sutures through the flaps, and securing their edges in contact with each other, until union has been efficiently established. Two or three fine curved needles, on rather long handles, should be ready-armed with fine white silk, slightly waxed; as soon as one needle has been used, it can be again armed, while another is in the hands of the Surgeon. It is best to decide at first how many sutures may be requisite; and also to observe carefully the points at which they

should be introduced; that when all are passed, their positions in each half of the palate may correspond, in distance, from each other, as well as in their distance from the margin of the wound; and also that those on one side should be directly in line with those opposite. The sutures, in each needle handed to the operator, should be at least a yard in length; and each suture should be doubled, for its whole length, before being passed. The Surgeon, with the needle in the right hand, and a pair of long spring-forceps in the left, should now push the point of the needle through the soft palate (on the patient's left side) as near to its anterior margin as practicable; for although this, the highest suture, is not intended to approximate the edges of the cleft so that they should touch, still, by slightly assisting to narrow the cleft, it adds much to the utility of the one below, when the operation is completed. For the reason stated the upper suture should be passed rather near to the palate-bone.

The point of the needle having been passed through the palate, should now be pushed inwards, until it becomes visible through the cleft: one thread of the suture is then to be seized with the forceps, and gently drawn forwards, *through* the fissure and out of the mouth; the needle should then be withdrawn, care being taken that the suture is left running through the palate, and each end secured outside the mouth. The second needle should now be introduced on the opposite side, in exact line with that on the left. When the point appears in the gap, the silk should be seized with the forceps; and *on this side*, in drawing out the suture through the fissure, care must be taken by the Surgeon to draw out *the entire loop*, and not simply one thread of the suture, as on the opposite side. The loop must be drawn forwards gently, until secured by the fore-finger of the operator, when the needle may be disengaged from the rest of the suture. There should then be on one side through the palate a single suture; on the opposite a double suture, the loop of which corresponds to the inner side of the fissure. The *inner* end of the single suture is to be passed through the loop of the double suture a short distance, and the ends of the latter gently pulled, until the whole double suture is withdrawn from the palate, and with it has pulled into the corresponding portion of the velum half of the single suture; and this now should lie across the fissure, with each end passed through a section of the soft palate. These ends of the suture should be secured outside the mouth, until all the succeeding ones, as many as may be required, are placed and secured in a similar

manner. One is usually required for the lower portion of the uvula.

As soon as the requisite number have been introduced, each should be separately tied; carefully, so as to adapt the edges evenly to each other; and not too tightly, that room be allowed for subsequent swelling of the soft tissues. If the sutures be tightly drawn, they most certainly will cut themselves out by producing ulceration of the part through which they pass. A slip-knot to bring the edges together, and a second knot over that, are sufficient to secure the suture, and maintain apposition until union is safe. The ends of the sutures should not be cut off very close to the knots: otherwise, when the silk becomes thoroughly sodden with moisture, the knots are almost certain to become loosened or untied in a very short time, and much too soon for safety.

The operation for closing the hard palate is a very different proceeding to that described as requisite for the relief of fissure of the soft portion. The result of some experience confirms the opinion long entertained, that, when fissure of the hard as well as of the soft palate coexists, the attempt to close the entire fissure at one sitting should never be made. Separate operations, at some short intervals, should be had recourse to, so as to close either the hard or soft portion first, and the remaining portion subsequently. There are several cogent reasons to render such practice generally desirable. In the first place, an attempt to close a fissure of the hard and soft palate at one operation, makes it a very long business for the patient to submit to; and as he has to keep his mouth open while the operator is at work, it becomes a most tiring and irksome effort, if the period is a prolonged one; to say nothing of the continued endurance of pain and other discomforts, which a patient must submit to in this operation. In the second place, the loss of blood which will often occur, in an operation on the hard palate alone, is sometimes considerable; often apt to make the patient faint, and so delay the completion of the operation. But should the attempt be made to close the hard and soft palate at once, the loss of blood is usually much greater, and often too great to allow of success in the attempt; especially when added to the various other reasons which militate against this proceeding. In the third place, a serious evil is apt to follow, when the attempt is made to terminate the operation at one sitting; the edges of the soft tissues both in front and behind are apt to ulcerate, and often to slough.

If the soft palate be alone operated on, some ulceration may and does often supervene; but it is rarely of such consequence as to be

ultimately of any importance, provided the palate has not been unnecessarily bruised or cut about. Under the circumstances above alluded to, the integrity of the tissues covering the hard palate contributes largely towards the nutrition of the somewhat injured soft palate; but if a large portion of the attachment of the soft tissues covering the bone be interfered with by their separation from the latter, not only is their intrinsic nutrition greatly reduced, but they can, by so much the less, aid in preserving the vitality of the soft palate, while its union and reparation become established. If, however, the soft palate be first selected for closure, and the operation be successful, the union of the flaps converts the anterior portion of the fissure into a foramen; and *pro tanto* aids in the nutrition of the soft tissues of the hard palate, when they are detached from the bone, at some subsequent operation; or if the hard palate be operated on first successfully, so much is gained in front, to assist in the nutrition of the soft palate, when it comes under the knife of the Surgeon.

Complete fissure of the hard palate, or one extending to or near the alveolus, is generally closed without much difficulty. The Surgeon should be provided with proper instruments for the purpose. The leading surgical instrument-makers have cases fitted up which contain all that is requisite for such an operation; and though it be not necessary to describe the instruments, it may be useful to state, that the knives used for dissecting off the soft tissues from the bone should be bent at or near a right angle with the shaft; that the broader the blade (in moderation), the more quickly may the soft tissues be dissected off the bone; and that, as the process of separating the tissues is rather one of peeling off the mucous membrane, than cutting it from the bone, the edges of the knives need not be very sharp.

The line between the oral and the nasal mucous membrane, at the margins of the fissure, is the guide for the course of the first incision. It is as well, at once, with a rather sharp-pointed bent knife, to run along this edge from its front to the soft palate, on both sides; with a broader bent knife the soft tissues must then be carefully detached from the bony palate, and as quickly as possible, *especial care being taken* not to bruise or cut through the former. If the edge of the knife tear it at any single point, the wound is apt to be followed by sloughing. To avoid such an occurrence, the edge of the knife should be kept constantly against the bony surface, and the soft tissues peeled off; so that if the knife be rather blunt-edged, it is an advantage.

The flap detached from the bone consists of all the soft tissues covering the latter—mucous membrane, areolar tissue, and periosteum. If the soft tissues are removed from the bone, in the manner recommended on the dead body, it will be found difficult (and we conjecture impossible in the living subject) to separate the thick mucous membrane from the subjacent periosteum. Therefore, the operation which Professor Langenbeck has proposed, and to which he has given the name of “the operation by muco-periosteal flaps,” appears identical with the original method of operating introduced by Mr. Avery.*

When the soft tissues have been effectually separated from the bone, the flaps should fall inwards and downwards, so that they meet in the median line, without the slightest traction exerted upon them. If the edges do not readily touch, the flaps have not been sufficiently detached from the bone on one side or the other; the knife must once more be passed round, to ascertain the point which prevents a sufficient descent of the flaps, and this should be freely divided: nothing must interfere with the free approximation of the edges.

When the fissure is extensive, and more or less complete, the free separation of the soft tissues from the bone is amply sufficient to allow the margins of the flap to meet easily in the median line; occasionally they will overlap. In such case, the edges require very careful adjustment. When the flaps are sufficiently detached, the bent knife must be laid aside, and their edges carefully pared; so that if they be a little ragged, they be made even; that the possibility of a mucous surface becoming insinuated between them be avoided; and that the contact of two entire and fresh raw surfaces be insured. The sutures are to be passed as already described. There is often some trouble experienced in passing them through the anterior part of the palate; but care and patience will usually overcome any difficulties that may present themselves.

When a fissure of the hard palate is complete, or nearly so, the sides of it will be found to approach more or less to the perpendicular in their direction. The result is, fortunately, that when the soft tissues are sufficiently detached from the bone, the flaps fall inwards and downwards, and readily meet in the median line; there is always ample material to permit of their arching over the defective roof, when they are once liberated from the bone.

But when the fissure in the bone is confined to the posterior half,

* See Prof. Langenbeck's treatise entitled *Weitere Erfahrungen im Gebiete der Uranoplastik mittelst Ablösung des mucös-periostalen Gaumenüberzuges*; Berlin, 1863.

the portion of the palate in front of the fissure, and whatever portions of the palate-processes exist at its sides, will be observed to approach, in curve, the arch of a perfect palate; the bony fissure will often be broad, and rounded in front; and the membrane covering the bones very thin. In such cases, if the soft tissues are merely detached from the bone at the sides and front of the fissure, there is not much spare surface to close the gap; consequently the edges of the flaps do not meet in the median line, so readily as occurs when the tissues are detached from the more upright sides of more complete fissures. Often a fissure of the posterior half is narrow, pointed in front, and its sides covered with thick velvety mucous membrane. Under such circumstances little difficulty is experienced in getting the edges together.

When cases with broad fissures of the posterior half of the hard palate are operated on, it is generally necessary to make lateral incisions through the soft tissues, parallel with the edges of the fissure, and close to the alveolar edge. The soft tissues between the incisions and fissure must then be separated from the bone; but great care should be taken not to injure the anterior or posterior extremities of these flaps, or in any way damage their connexion in front and behind; the flaps must then be fastened together with sutures. Sometimes it will be found desirable to plug the incisions with a little soft cotton: this helps to push the flaps towards the median line, and takes off some of the traction of the sutures; this traction being almost unavoidable in instances in which the gap is an unusually broad one.

Such cases as the latter are the most unsatisfactory to deal with. In some instances it will be found best to close the soft before attempting the hard palate; for experience has taught us that the continued action of the muscles of the soft palate, closed by operation, has always a tendency to contract any opening left in the hard palate.

If the gap left should appear too large to be benefited by a subsequent operation, it would be better that the patient should use an artificial palate; at any rate, for some time, or until the ultimate benefit of the first operation can be estimated.

When a partial and posterior fissure is pointed in front, there is less occasion for lateral incisions; but it is better to make such incisions in every case, rather than run the risk of the sutures making too much traction on the flaps, and cutting themselves out by ulceration, produced by their pressure on the points of insertion.

It frequently happens that, under the most favourable circumstances, and with the greatest care on the part of the operator, a

small pin-hole aperture, or fissure enough to admit the flat end of a probe, will remain at the meeting-point of the hard and soft palate. Under such circumstances a metal plate should be worn for a period, *over the opening*, in order that the percolation through it of saliva and other fluids be prevented. Under this treatment it has a tendency to close. But if any substance, such as a plug, &c., be made to project continually *into the opening*, and thus press on its margins, it will invariably and gradually increase in diameter; the plug will become useless, and must be replaced by a larger one, and this will be followed by progressive increase in the size of the aperture.*

If it should happen that a patient, with hare-lip and cleft alveolus and palate, should not have had the lip operated on in childhood, it will, in all probability, be found that the cleft of the alveolus is considerable,—sometimes sufficient to allow the point of the finger to be passed through it from nostril to mouth. Under such circumstances the first care should be to operate on the lip. It will be found, subsequent to the healing of the lip, that the action of its muscles, in a very short time, will have approximated the edges of the separated alveolar ridge, often so as to make them touch; though, in consequence of the interposition of the mucous surfaces, the chink between them never appears to be obliterated, unless the mucous membrane be removed.

Occasionally small orifices are met with in the palate, either congenital, or more frequently the result of some cachectic or syphilitic condition, terminating in necrosis and destruction of a portion of the bony palate. In either condition, some little difficulty will usually be encountered in attempts to close such orifices. In all instances, lateral incisions are requisite; and frequently a repetition of the operation may be necessary, even more than once, before entire closure be effected. But, under any circumstances, should the opening be not ultimately filled up, it will generally be greatly reduced; so that the patient will be enabled, with the aid of

* The author would not be doing justice to the memory of the late Mr. Avery, unless it was mentioned that he was the first Surgeon in this country to close entirely a complete cleft of the palate. Since then the operation has been frequently and successfully performed in England and on the Continent. To Dr. Warren, of Boston in North America, the profession is chiefly indebted for having advocated the closure of the hard palate by operation. In the *New England Medical and Surgical Journal*, and also in the *American Journal of Medical Sciences*, as early as the year 1843 (also in 1848), Dr. Warren gave the result of his operations on fissures of the hard as well as the soft palate. Although complete closure does not appear to have been effected in any of these cases by *one* operation (which Dr. Warren appears always to have had recourse to, to close both hard and soft palate), yet his success by subsequent treatment in the management of these cases marks him as one of the pioneers in the advancement of this department of Surgery.

an artificial palate, to secure himself from the discomforts attendant on a perforation of the roof.

Orifices through the soft palate are usually, if not always, the result of ulcerative action. Generally they close after a time, without the assistance of an operation. An opening, the result of strumous ulceration of the soft palate, and of the size of a sixpenny-piece, in a patient under the care of the author, contracted and closed entirely, after cicatrisation of its margins had occurred, without operation or any surgical treatment. When, however, such an opening ceases to contract, and holds out no prospect of natural obliteration, but promises to be permanently patulous, its edges should be pared, lateral incisions made, and the margins brought together and retained in apposition by sutures.

The amount of blood lost during the performance of an operation on the palate will vary to a very great extent in different cases; but usually much more is lost in the process of detaching the tissues from the bone, than in the operation on the soft palate. The anterior and posterior palatine vessels sometimes bleed profusely after division; so much so, that occasionally it becomes necessary to make pressure, for a few moments or more, with the finger; especially on the anterior, which generally bleeds more profusely than the posterior vessels. Iced or cold water should be used frequently, to wash out the mouth during the operation, when hæmorrhage is free. The loss of blood in no one operation, under the experience of the author, has been attended by evil consequences. Women are often apt to faint with a small loss of blood, added to the fatigue of the operation. In one instance which occurred to the author, the operation was obliged to be completed while the patient was lying on the floor.

It is not only advisable, but often necessary, to administer plenty of stimulants to the patient during the operation, to endeavour to obviate the effects of the loss of blood; and also to encourage the patient who flags in determination to go through with the operation.

The patient should always be provided with his usual meal previous to the operation. For some days after, *he must be plentifully supplied with nutritious fluid and soft food*: strong beef-tea, bread-and-milk, tea with half milk or cream, strong soup, and beer or wine. From the first hour after the operation, strict attention to this rule forms an important element in the satisfactory union of the flaps.

It might be supposed by some, who have not experience in this class of cases, that, after an operation on the soft palate, the effort of swallowing would be an effective impediment to union, in consequence of the action of the muscles of the palate; but it must be borne in mind, in the first place, that, prior to the operation, the palate-muscles had no power in themselves to assist in the act of deglutition; they could not close, between the ori-nasal cavities, on the passing food; in fact, that the process of deglutition is initiated in the back part of this ori-nasal and pharyngeal cavity, by the extremely educated action of the superior constrictors of the pharynx. In the second place, the divided, and to an extent crippled, muscles of the palate are naturally passive in deglutition until reparation is established and complete. So, in practice, it is found that, as long as a patient is restricted to soft or fluid articles of nutriment, union is not retarded by the mechanical action of deglutition, however often he may be fed in the day. But if all diet be withheld, the patient's strength, already lessened by loss of blood, becomes lowered to such an extent, that reparation is rendered doubtful, and union of the parts is retarded, if not ultimately prevented. All hard

food should be avoided for a week or ten days; such as solid meat, potatoes, dry bread, &c.

The sutures should not be permitted to remain in the flaps many days. Usually, in the soft palate, the two lower ones should be removed on the second day; and if there be four sutures, one of the two latter should be taken away each succeeding day: that which is highest, to be last removed. It has been supposed desirable to retain the sutures in the flaps for a longer period; but in each fresh case that comes under our notice, it becomes more evident, that if union is satisfactorily established, the retention of the sutures beyond the third or fourth day only tends to render it less effective: and if the condition of the edges of the approximated flaps is not satisfactory, and their union is not firm, the presence of the sutures will aggravate rather than diminish the evil.

The patient should not be allowed to speak until union is complete, and the sutures are removed. He should be provided with materials for writing all his wants; a small slate and pencil will be found most convenient for such a purpose. It is not requisite to confine the patient to bed after the operation; but in some instances individuals prefer to lie still for a few days, especially if they feel weak from the loss of blood. The condition of the tongue, before or after the operation, must not be taken alone as indicative of the patient's condition. All persons afflicted with cleft palate are liable to a dry, rough, and often coated tongue—the result of the constant passage of air in respiration over the surface opposed to the fissure. The injury, from the operation, to the soft tissues of the roof, generally sets up a slight degree of feverish excitement, with a very coated tongue for a few days. This condition of tongue must not be taken to indicate the want of purgative medicine. In an instance under the author's notice, this state of the tongue was mistaken for a symptom of some great general disturbance of system, and to remove it, two consecutive doses of calomel were administered within four days of the operation: the patient became salivated a week after the operation, and the wound, which had been most satisfactorily united, gave way entirely under the salivation.

We cannot too strongly urge the point that, previous to any operation for the closure of clefts of the palate, the Surgeon should satisfy himself, that the patient is in a condition of health to justify the expectation, that "*union by first intention*" will follow the adaptation of the raw edges of the flaps to each other. The success of the operation depends on immediate union of the edges: if they do not unite at once, there is no hope that they will do so secondarily, when in the stage of granulation. We ought to be most particular not to recommend an operation, should the patient show any sign of disordered health or defective power—pustules, herpes, excoriated lips or nostrils; in fact any indications, trivial in themselves, and perhaps of

no import in the balance which influences other operations, should in cases of cleft palate be decisive against operative interference, until a clean bill of health can be written for the patient.

It may be asked, what amount of improvement in articulation and speech is effected by the operation, in patients who successfully undergo it. Dr. Warren states: "There is generally more facility of speech, which, so far as it has been in my power to watch patients at a distance, is constantly improving. A young man was present at a meeting of the Boston Society for Medical Improvement, about two years after the operation, and it was difficult to discover the least imperfection in his speech, although it had previously excluded him from society."*

The author has found that in many cases the improvement has been most marked and satisfactory; and, in almost all, sufficient to render what was unintelligible readily comprehended: in one case, a stranger could not have detected a defect in articulation, or the delivery of a long sentence, three years after the closure of the entire palate. In all cases time is requisite, and much pains must be taken by the individual, to acquire the power to articulate clearly such letters and words as, without a roof to the mouth, the tongue cannot command. It becomes, in fact, a task to the patient to learn how to pronounce correctly and distinctly a new dialect. The condition of the upper incisors is often very defective in these cases of cleft palate: always more or less so when the cleft has extended through the alveolar ridge. Such cases should be placed in the hands of an experienced dentist, when the Surgeon has terminated his work; for this irregularity of the teeth will often form a complete impediment to the improvement in articulation, although the palate may be most satisfactorily closed. The substitution of artificial teeth in front, in place of the defective ones often found in these cases, is not only of considerable assistance towards improving the power to articulate more distinctly, but also materially lessens a deformity so long a prominent feature in such patients.

It would be invidious to the task the author has undertaken, in writing this article, as well as deficient in respect to those who have devoted attention to the subject it refers to, were he, in conclusion, not to mention the names of Roux, Cloquet, Mettauer, Mütter, Pancoast, and Dieffenbach, with those of Warren, Avery, and Fergusson. Each has so far aided in turn, to improve this once apparently difficult and almost hopeless operation, that it can now be confidently looked upon as certain to effect closure of the most extensive cleft, and almost certain to improve thereby the most defective articulation.

DISEASES OF THE LIPS.

The congenital defects of the lips and of the mouth, and the treatment applicable to each, are described elsewhere in this work; as also the diseases of the tongue, and their treatment. In the following section will be described the diseases of the lips, jaws, and floor of the mouth.

The diseases of the lips are usually so marked, that they greatly affect the appearance of the individual; and they are often so serious, that they demand the most careful attention of the Surgeon.

Simple "*cracked lip*," when superficial, may be the result of long-continued cold weather, acting upon a constitution somewhat out of order. The crack is usually near to, or at the middle of the

* *American Journal of Medical Sciences*, April 1848.

lip; is not deeper than through the mucous covering; is often excessively painful when stretched, and readily bleeds if its edges be accidentally and suddenly separated. It may generally be relieved by slight attention to constitutional measures; an alterative, with aperients, if requisite, or such other remedies as the condition of the patient may indicate. The application of caustic will often relieve the pain at once; and some simple salve constantly applied keeps the surface soft and supple, and prevents its edges from getting dry and tender.

Should such a slight but painful crack be neglected in early life, and no measures taken to relieve the patient of this troublesome recurring sore, it will often happen that the crack deepens, and becomes more permanent in character: it becomes located in the part; and appears sometimes so deep, that it might be supposed that the middle line of the lip had been grooved out by ulceration; a very unsightly furrow, occasionally of considerable depth, is thus formed, to the great deterioration of the personal appearance of the individual. Under such circumstances, the relief, which in former years would have been readily obtained, is now no longer so available; for though the ulcerated base of the furrow may heal under judicious treatment, it will leave a chink or gap in the middle of the lip; and nothing short of paring its edges will remedy it. Under these circumstances, an operation may be recommended and undertaken, should the patient be in any degree desirous to have the disfigurement remedied. The edges when pared should be brought together with one or two fine sutures.

Cracks of a severe character are generally observed in the under lip; but fissures are not at all uncommon in the upper one. These usually occur in children, and are mostly associated with, if not always indicative of, a scrofulous constitution; enlarged cervical lymphatic glands are constantly present in such children. Such a condition of lip is often obstinately persistent, and can only be combated by such measures as are advisable for the improvement of the general health. If very painful, an occasional application of a strong solution of nitrate of silver will relieve the extreme sensibility, for this will be sometimes very distressing in the movements of the lips; indeed so much so occasionally, that it interferes with the ready and comfortable use of the lip in conversation or during eating.

Fissures or ulcers of the commissures of the lips, or of their inner surfaces, should be very carefully looked to. In children they are usually transient, innocent, and associated with some passing constitutional disturbance; or more obstinate, and grafted on a strumous habit. In adults, or after the period of childhood, such ulcerations or cracks about the commissures must be regarded with extreme care and some suspicion, under apparently the most innocent and unsuspecting circumstances: as a rule, they are the results of former syphilitic taint, and form one of the numerous varieties of secondary syphilitic affections; other indications, confirmatory of such contamination, will seldom be found wanting; and the condition of the part will be subservient to the treatment adopted for the general condition of the patient.

A troublesome, and often a recurring evil, which the practitioner has to combat, is the tendency, in some persons, of inflammation of the mucous membrane of the mouth to run into aphthous ulcers. Such ulcers sometimes become deep, and may be some days before they assume any tendency to heal. They occur on the side of the tongue, the lips, and frequently on the frænum of the tongue. They are always painful, sometimes exquisitely so; and their extreme tenderness may last many days, though the ulcer itself be not more than the flat surface of a split pea. The ulcer is generally ashy on its surface, as if covered with a superficial slough of mucous membrane; the surrounding membrane is red, and slightly swollen.

These ulcers, whether aphthous or more extensive, are generally attendant on some constitutional disturbance. In some individuals they constantly recur; and in such persons, either some peculiar delicacy of health, or perhaps some local climatic or other influences, may be their exciting cause. The pain of the ulcer can be at once relieved by touching the surface gently with a point of nitrate of silver. It is as satisfactory as it is unaccountable, to observe how immediately the application of this caustic removes the often exquisite pain—pain which may render the patient almost unable to eat or talk. The ulcer usually ceases to be felt after the caustic is once applied, and heals without further trouble; a second application is rarely requisite.

The constitutional measures must be guided by the circumstances of the case, as the recurring form of ulcer is usually associated with a delicate state of health. Every attention must be given to the improvement and invigoration of the system. But medicine will frequently fail to produce that which change of air, soil, scene, and circumstances effect in a short time, and as frequently in an unexpected manner.

Vascular growths of the Lips, &c.—The tissues of the lips and cheeks are favourite localities for the commencement of naevi, or vascular growths, whether of arterial or venous constituents. Such masses are unsightly at best, and are usually brought to the notice of the Surgeon at an early period for treatment. The nature of the treatment is necessarily various; and the variety in treatment is dependent, in a measure, on the amount of the diseased structure. The naevus may be but a small red superficial patchwork of vessels; or it may be a large soft spongy cluster of veins, spreading over a very large section of one side of the face. The small arterial bright

vascular patches are most common; though often a very large spongy venous nævus on the cheek may be observed in very early life.

When small arterial nævi are found on the margin or inner surface of either lip, and are entirely superficial, they may be disposed of in several ways; but the application of the ligature is the most rapid, the most certain, and not more painful than any other. A needle passed through the base, and a fine ligature tied under the needle tightly round the mass, rapidly and surely effects its removal. In the course of a few days the slough will have separated; and in a few more, the wound, which at first may appear formidable after the removal of the slough, quickly contracts and cicatrises.

If the diseased mass of vessels be larger, and dips into the substance of the lip, and as yet has not spread laterally, but involves more in depth than in breadth, it may become a question whether it be better to cut out the diseased mass, as in an operation for cancer of the lip, or to destroy it by the repeated introduction of ligatures through its substance, tied tightly, so that the mass be cut up into several pieces. If the mass involves the whole thickness of the lip and the opposed surfaces of mucous membrane and skin, and, though extending towards the root of the lip, does not spread laterally, and can therefore be readily removed by incision, there are reasons for such treatment being preferred. The disease is at once got rid of; the relief is effectual; the operation is simple; the recovery is quick; and the scar left after union is but slight. The only precaution requisite in the performance of such an operation is to take care that the incisions are made through healthy tissue, and beyond the diseased vessels. The margins of the wound are to be brought together, as in the operation for hare-lip.

But rather than sacrifice skin or mucous membrane, if either or both are much implicated, it is far preferable to have recourse to ligature: if the disease spreads laterally, or extends in any degree into the cheek, ligature alone must be used.

Under the circumstances of ligatures being applied to such nævi of the lips and cheeks, it should always be borne in mind that scar must be avoided as much as possible, and mucous membrane saved as much as can be. The one is an eye-sore; the loss of the other is apt to produce distortion of mouth and a contracted cavity. Therefore, in using a ligature for nævi of the face, it is best to pass the thread entirely subcutaneously, and to tie it at the common point, where it entered and emerged from the skin, so that no portion of the latter be destroyed. One ligature may be sufficient in slight cases; but in others several may be requisite to completely obliterate and destroy the diseased structure. The object to be kept in view in introducing the ligatures, is to effect the entire division of the diseased mass of vessels in several directions,—that, in fact, they be cut into several pieces; so that if, in the first instance, a ligature be introduced round a portion of the tumour, in the second operation one should be passed across; that each ligature should act on a fresh part; that ultimately the original mass may be divided into so many portions as will insure the consolidation of all the diseased tissue.

If the ligature be introduced on a needle at one point, and carried partly round the mass subcutaneously, and brought out at some distant point,—again introduced and carried in or through until it reach the original puncture, and the ligature then tightly tied at this opening,—no skin need be destroyed, or mucous membrane cut or damaged. Each ligature should be tied as tightly as possible. It will soon cut its way free. The ends of the ligature should not be left too short; otherwise they may become buried in the wound in the subsequent swelling of the parts, and probably would cause suppuration to a greater extent than desirable, or even occasion some difficulty or delay, from being retained in the wound. The more tight the ligature is tied, the more speedy will be its release from the tissues which it grasps.

Vaccination should only be tried in very small nævi; the introduction of caustics, setons, the injection of perchloride of iron, each have their advocates;

but none of these secure more effectual obliteration of a nævus than the ligature : they often fail to secure it as rapidly ; they often set up more irritation than is requisite for the purpose in view ; they sometimes occasion sloughs of the skin ; and they are more painful in adoption, inasmuch as, being slower in action, their application must generally be often repeated before a satisfactory result is insured. The galvanic cautery has often been employed by the author ; but after a great number of experiments in the treatment of such cases, he is satisfied that subcutaneous ligature will invariably be found quickest in action, most effectual in result, least objectionable as regards scar, and, so far, less painful than any other kind of treatment. This is the case whether a nævus of the lip be large or small ; unless the case be more suitable for the knife.

Cancer of the Lip may be said to be confined to the lower lip, it is so rare in the upper : it is certainly more frequent in males than in females, the proportion being relatively large in the stronger sex.

The characteristics of cancer affecting the lip deserve particular attention. As a rule, we may say it is found to consist of the epithelial variety.

“Epithelial cancer has its primary seat, with very rare exceptions, in, or just beneath, some portion of skin or mucous membrane. Its most frequent locality is the lower lip, at or near the junction of the skin and mucous membrane.”* Commencing sometimes as a small warty growth on the lip ; sometimes as if the mucous membrane were excoriated, with the excoriation resting on an inflamed and thickened base ; sometimes as a small, indolent tubercle : the condition, which does not at first excite suspicion, by degrees is seen to alter and the growth to increase. The wart grows in breadth and thickness ; the excoriation becomes deeper, and rougher on its surface ; the tubercle peels and ulcerates, scabs and peels again ; until, sooner or later, the persistence of the mass, or the heat and pain of the part, attracts the more serious attention of the patient, and he then seeks for relief.

It is unnecessary here to enter upon the question of the pathology of cancer, or of its cachexia ; the subject having already been discussed in the essay on CANCER, Vol. I.

We pass on at once to the consideration of diagnosis and treatment.

The diagnosis of cancer of the lip may at first sight appear simple enough ; and yet a certain degree of caution must be recommended, ere an opinion be definitely arrived at, as to the precise character of a hardened sore, or of a raised tubercle of the lower lip. As to the author, so no doubt to many others, it must have frequently occurred, to have to point out, that a previously supposed cancer of the lip was but a chancre, contracted in that part ; and without some little care and consideration, a chancre of the lip may be readily mistaken for the more serious, and the often primarily similar sore. The surface under both conditions may be superficially excoriated ; the lip may be thickened at the part ; the sore may rest on a hardened base ; and there may be the additional suspicious circumstance of attendant enlarged

* Paget's *Surgical Pathology*, vol. ii. p. 412.

glands in the submaxillary region. It must, however, be borne in mind, that cancer of the lip is somewhat slow in its progress; that the cervical glands do not usually indicate the more grave implication of the constitution at an early period: whereas in chancre the glandular enlargement would be apparent in six or eight weeks, at the latest, from the first appearance of the sore; and probably, if no specific treatment have been adopted, other evidences of secondary symptoms, such as eruption, sore-throat, &c., would be manifest within six weeks of the first infection. As a mistake in diagnosis between cancer and chancre of the lip has often been known to occur, a few remarks, in passing, on such a subject will probably not be thrown away.

Cancer of the lip is a disease of advancing, if not of advanced, life; but man is often depraved, and experience teaches us that age need not be taken as a bar to the occurrence of a chancre of the lip. A gentleman, past the meridian of life, and on whose head time had more than showered a few snow-flakes, applied to the author with a condition of lip which had excited suspicions as to its cancerous character. The appearance of the sore itself was extremely deceptive; scattered and isolated glands, slightly enlarged, and hard, were to be felt in the submaxillary regions; and his position and circumstances in life rendered it most improbable that a chancre could have been contracted on such a part. This sore was found to be accompanied by a commencing faint lichenous eruption. The patient was put under a mild course of mercury, and rapidly recovered; the hardness at the base of the sore entirely disappeared.

The characteristics of the two affections may thus be summed up: Chancre of the lip may occur at any period of life, and is as often seen on the upper as the lower lip. Youth is the most probable period of infection; and we say, with regret, it is most frequently observed in women: it sooner or later forms a superficial sore, raised on a base of an almost cartilaginous consistence: the surface appears more like an excoriation than an ulcer; or the surface may have cicatrised, and the hard base remain. The glands of the submaxillary spaces enlarge at an early period, some six or eight weeks after the sore commences; and though hard, small, and scattered usually, they sometimes attain a large size. In one instance which came under the author's notice, the glands on the right side were very much enlarged, and on the inside of the right half of the lower lip was a large hard mass of cicatrix, the original sore of which had entirely healed some weeks previously. Secondary symptoms will sooner or later appear, unless early treatment be adopted.

Cancer of the lip is a disease of advanced life; affects the lower lip mostly; is most frequent in men; does not progress uniformly, and usually slowly; does not implicate the absorbents at so early a period as chancre; does never thoroughly heal up and cicatrise like chancre. The disease is usually of the epithelial variety of cancer, and varies a good deal in its method of commencement, in its progress, its growth, and its appearance; while the characteristics of chancre are uniform in most persons. Cancer always contaminates the absorbents, if allowed to run its course unchecked; ultimately it destroys, locally, all tissues in contact with its surface; the whole lip may be affected; large cancerous masses exist, at the same time, from the symphysis to the clavicle; and death ultimately follows.

The treatment of cancer of the lip usually resolves itself into removal by knife, or destruction by caustic. In the opinion of the author, it should entirely resolve itself into that of the knife; and the earlier such treatment is adopted, the better the prospect of prolonging life.

The Surgeon having decided to remove a cancer of the lip with the knife, the patient should be seated in front, with his head

steadily supported by an assistant; or the patient may lie on a sofa. Chloroform need hardly be administered, unless at the particular desire of the patient. If the disease occupy but a small portion of the lip, the mass may be removed entirely by a V-shaped cut through the healthy structure. The lip may be transfixed with a thin straight knife, and then cut upwards on either side of the diseased tissue; an assistant should hold the flaps as they are liberated from the diseased part. The flaps are to be brought together with pins and the twisted suture, or by sutures alone; care being taken that the margins of the prælabium, or mucous edge, be accurately adjusted. One, two, or three pins may be requisite; some surgeons prefer sutures without the aid of pins; and silver sutures answer the purpose very satisfactorily. If pins be used, as soon as they are fixed by suture, the sharp-pointed ends should be cut off, and the remaining ends so protected that they be not readily caught by the dress, &c. of persons in attendance, otherwise the patient runs the risk of being accidentally very much hurt, for want of a little foresight. In all these operations the pins or sutures should be removed at the end of forty-eight hours at the latest, and the wound supported by adhesive plaster.

If a large surface of the lip be affected, and the disease be superficial, it may be readily removed by a semicircular sweep of the knife, or a cut with a pair of curved scissors; in either case the opposed edges of skin and mucous membrane should be brought together with sutures. In the incisions through the lip, the labial arteries bleed freely. With the aid of the pins and twisted suture the hæmorrhage is readily and effectually checked; with the semicircular incision a ligature or two may be requisite.

It will save some little inconvenience, and also pain, to have the sutures well oiled before they are twisted round the pins: by using this precaution, it will be easy to remove the sutures subsequently, as they are readily detached from the pins; when not oiled, they adhere to the pins and to the skin, and always occasion pain when removed.

The use of caustics, in cases of epithelial or other cancers of the lip, is but waste of time, and an unnecessary infliction of suffering; provided the disease be not too far advanced for removal by the scalpel. The knife should always be used when practicable; caustic, only when the disease is too far advanced for removal by the knife. But even then it is doubtful whether any application of caustic, by retarding growth or destroying material, compensates for the pain, often exquisite suffering, which is inflicted by its use. It is a question worthy of consideration, whether caustics of any kind act beneficially in any cancerous affections. If caustic be decided on, the most efficient is the chloride of zinc, applied in the form of a paste.

The advantages of operating early can only be appreciated when com-

pared with the more rapid results of a case which is allowed to run its course unmolested. But under the most favourable circumstances, we can only expect the operation of removal to relieve for a time; the disease usually returns, and generally shows itself in the glands of the submaxillary region. These in time increase to a great size; the skin over them ulcerates and sloughs; an ulcerated and fungoid surface discharges profusely, and often bleeds largely: and life is thus drained away. We cannot here more fully discuss the advantages of the removal of cancerous affections of the lip; but as such affections are not ultimately amenable to any treatment, nor the disease ever eradicated by topical remedies, their entire removal offers the speediest prospect of present relief; and though such a measure should be adopted, as soon as the disease is decided to be cancer, the remedy is at best but a choice of evils, and must never be held out as one of radical benefit.

Cysts of the lip are not infrequent. They are generally observed near the free border, or inner surface; usually of the lower lip. They sometimes increase to an inconvenient size. On the margin of the lip they seldom project beyond the mucous membrane; the skin is usually free. They are generally well raised from the surface; covered by very thin membrane; usually semi-transparent, but occasionally somewhat discoloured and of a venous hue, as if veins traversed or opened into a cavity.* They contain either viscid clear mucus, much like the contents of the cysts termed *ranulæ*; or sometimes a darkish fluid of thick consistence. They are generally single, though their surface and shape may be irregular. They seldom grow large; though this may be the result of locality, as the Surgeon is usually required to remedy the evil before it occasions much inconvenience, or becomes unsightly.

Such cysts are usually innocent in their character; do not recur in the part when effectually treated; nor are they congenital, unless of that variety alluded to as connected with blood-vessels. These cysts are often not larger than small peas, or from that to the size of a small walnut; painless; indifferent to being handled; and only inconvenient from size or disfigurement. They occasionally remain stationary for life; are then usually small in size, and frequently discoloured; the more transparent ones have the greatest tendency to increase, as if dependent on the secretion of a gland, which probably, having had its duct obstructed, has given rise to the formation of the cyst.

The treatment to be adopted in such cases is very simple, and usually satisfactory. The cyst should be freely divided, and its contents allowed to escape; when entirely emptied, it is best to wipe out the cyst with dry lint, and then freely apply strong nitric acid to the whole surface of the lining membrane. Though the

* "Cysts formed of dilated portions of blood-vessels shut off from the main stream." Paget, *op. cit.* vol. ii. p. 27.

treatment be rather sharp for the moment, the pain soon subsides, and the patient is then able to eat and talk as usual. No Surgeon should be satisfied with simply puncturing such cysts; a puncture, or even a small incision, will frequently close before the cyst is obliterated; and in a few days it becomes as large as it was originally. Even after the application of nitric acid, unless the opening be free, and care taken to keep it so, until the cyst be entirely destroyed, the accumulation of fluid is very apt to recur. It is a good precaution to touch the edges of the opening with nitric acid for a few days consecutively, to insure its not closing until suppuration be fully established, so that the cyst be obliterated. Occasionally a cyst in the lip is complicated with some solid growth. Such growths are usually somewhat of a glandular nature,* and very favourable for removal. These tumours are not common. They resemble, to some extent, the mammary glandular tumours in consistence and character; or "they may appear intermediate between the foregoing and those tumours which are found over, or near, the parotid gland, and consist of mixed glandular and cartilaginous tissue."† Mr. Paget refers to a case removed by himself from the upper lip of a man; and describes a second case, which occurred under Mr. Lloyd's care, in a man who had a tumour in his upper lip for twelve years, when it was removed. "The tumour was firm, slightly lobed, yellowish-white, smooth. In general aspect it resembled the mixed tumours over the parotid; but its minute structure presented as perfect an imitation of lobulated or acinous gland-structure as any mammary gland."‡

Cysts of the mouth may be congenital, or the result of obstructed ducts; ranulæ; or possibly bursæ between the muscles of the tongue.

Congenital cysts of the mouth are not frequent, though they occur sufficiently often to be familiar enough to Surgeons. Mr. Cæsar Hawkins long ago drew attention to their real character. Usually such cysts are single, and may increase to a large size; or they may be multilocular and numerous, and occupy a considerable portion of the floor of the mouth. Whether single or compound, they will usually be found between the lower jaw and the tongue; if large, pressing the floor of the mouth forwards and upwards, and the submaxillary soft tissues outwards and downwards. An infant three weeks old was sent to the author by Mr. Frank Buckland, then assistant-surgeon of the Second Life-Guards. The mother found that the child suckled with increasing difficulty during the last few days, in consequence of a swelling on both sides of the floor of the mouth, which was pushing up the tongue, and had much widened the lower jaw. It had also encroached backwards so as to press somewhat on the larynx and pharynx; respiration was somewhat impeded; deglutition was slow and difficult. Under the tongue and

* For a specimen, see Museum of St. George's Hospital; referred to also by Mr. Paget, vol. ii. p. 73.

† Paget, vol. ii. p. 262.

‡ Ib. p. 263.

on both sides of the mouth there projected a lobulated irregular cystic mass ; some portions of which, especially on the left side, were so prominent, that the tongue was pushed upwards by it, and the tumour bulged out between the tongue and the lower jaw, to such an extent, that the infant could not close its lips. An irregular lobulated swelling projected on each side of the throat, immediately below the lower jaw.

The cysts projecting between the tongue and lower jaw were thin and pellucid, the membrane covering them pale-coloured, and free of vessels on its surface.

A seton passed through a cyst on the left side soon allowed it to collapse ; a thin purely transparent fluid oozed out through the punctures. On other days other threads were passed through some of the more prominent cysts, while some were punctured. The partial reduction of the sublingual swelling enabled the infant to partake more freely of food, and for some days a slight improvement was observed in his condition. This was but transient ; evidently other and deeper cysts became larger ; gradual increase of dysphagia and dyspnœa supervened ; and the infant died, greatly emaciated, the sixth week after its first visit to the hospital.

On examination, it was found that this cystic formation involved all the tissues, between the mucous membrane of the floor of the mouth and the skin covering the submaxillary region ; so that not only did the mass of cysts (it might be termed a multilocular cystic tumour) project upwards in the mouth, but downwards on both sides, in the submaxillary spaces. On a section of the tongue, the whole muscular structure was seen studded with cysts ; small and millet-like in some parts, rather larger in others ; some single, other multilocular. The larger ones were generally multilocular, with bands running across and around their walls.*

Other forms or characters of cysts are occasionally observed in the mouth, sometimes between the gum and the cheek. Mr. Paget describes a case of this nature, which occurred in a woman, in whom a soft elastic swelling pushed out the thin mucous membrane of the upper jaw, producing externally an appearance somewhat similar, at first sight, to distention of the antrum. An incision into the cyst allowed the escape of nearly an ounce of turbid brownish fluid, containing crystals of chlorestherine.

Cysts connected with defective development of teeth, "denti-gerous cysts," usually confined to the alveolar regions of the maxillæ, are not uncommon. Their history and treatment are related by Mr. Salter, and will be found at page 32 of this Volume.

Obstructions of mucous follicles occasionally give rise to the formation of mucous cysts, already spoken of ; the obstruction of the submaxillary or sublingual ducts may be productive of the cysts termed "ranulæ."

Again, congenital sebaceous cysts are occasionally found among the tissues of the floor of the mouth. A young woman was admitted into St. George's Hospital, under Mr. Hewett's care, with a considerable swelling on the right side of her mouth and neck. The swelling bulged into the mouth ; had displaced the tongue to the opposite side ; and protruded downwards in the submaxillary region. The swelling was painless, but inconvenient from its size ; it had been many years forming, and it was doubtful

* The preparation is in St. George's Hospital Museum.

whether it was congenital or not. A free incision through the portion projecting into the mouth, allowed the escape of a large quantity of a thickish yellow fluid, most offensive and putrid in smell, similar to the contents of a suppurating sebaceous cyst. By degrees the cavity contracted and closed, and the patient left the hospital cured.

The diagnosis of cysts of the mouth is not often complicated: usually, fluctuation is very evident; as frequently, the surface of a portion of the cyst projects into and on one side of the mouth, so that it may be seen covered only by mucous membrane; the walls are thin and pellucid; the contents visibly transparent, or slightly tinged from some accidental circumstance or individual peculiarity.

In other cases these cysts present more obscure conditions: they may lie deep among the muscles of the floor; or may press backwards and interfere with the movements of the larynx or pharynx; or a sanguineous tumour may be mistaken for a cyst, though sanguineous tumours are exceedingly rare in these parts.

Such serous and mucous cysts as we have referred to, may be treated without hesitation, and without much danger. If very large, it may be as well to draw off a portion of the fluid, in the first instance; and subsequently have recourse to setons, or injections of iodine. But as in any operation in the region of the mouth and neck, œdema may occur about the root of the tongue and the fauces, and interfere with deglutition or respiration, it is better to select the less irritating and most simple treatment, before proceeding to the more heroic.

In the treatment of *mucous* cysts of the mouth, a seton, or injection of iodine, will often be found inefficient; the cyst may fill again in a short time. If a portion of the cyst be cut away, the contents allowed to escape, and nitric acid applied freely to the interior, the treatment will generally be found successful. Some of the small, isolated, mucous cysts, situated immediately under the mucous membrane, may be readily removed by the knife; but the attempt to remove a large and more deeply-seated cyst is hazardous and unnecessary. Mr. Fergusson relates a case which illustrates the difficulties a Surgeon may encounter in such a proceeding, and the danger the patient may undergo.*

We would strongly dissuade the attempt to remove a large cyst in the region of the mouth; not only are there considerable obstacles to the entire removal of the cyst from its bed, but the operation must necessarily be a tedious one, and there would be risk of great loss of blood. By laying the cyst freely open, in all

* Fergusson's *Practical Surgery*, p. 599.

probability it will close up from the bottom, or, at any rate, become so much diminished, that ultimately a series of punctures, or openings, a seton, or injection of iodine, will effect its obliteration. A silver wire may be used as a seton, if the cyst project more towards the integuments than the mouth, and the contents, by tapping, are proved to be clear and thin; but if opaque, dark-coloured, thick, or purulent, a free incision is the safest, the most effectual, and the least tedious treatment to adopt.

A large cyst opened by incision in the mouth, and found to contain purulent fluid, may not contract very rapidly, in consequence of matter bagging downwards in the neck, in the lower part of the sac. Under such circumstances, a small opening may be made under the jaw. But as a scar in the neck, especially in women, is always objectionable, such an opening had better be avoided unless absolutely requisite.

By far the greater number of the different varieties of cystic formations (independent of bone) will be found on the inner surface of the lips, the surface of the gums, or on the floor of the mouth; and the treatment above described may be followed accordingly, care being taken to ascertain first the character of the fluid contained; for should the contents be blood, the treatment should be different to that described.

Sanguineous cysts about the mouth are rare. When present, they are usually seen on the lips, near their free border. Instead of free incision, when deeper seated they should be treated with setons or ligatures; when superficial and accessible, they may be dissected out, or included in a ligature, like a *nævus*.

To sum up the evidence on the history of mucous or serous cystic affections of the mouth, we find that, in early life, they occur either singly or in clusters; are generally of a congenital nature; and are found most commonly on the floor of the mouth, or, in after life, on the surface of the gums. Venous or sanguineous cysts are generally observed in the lips and on their inner surface; are usually congenital, and frequently stationary; in this they differ from other cysts. Sebaceous cysts, containing sometimes a mixture of epithelial, thick, white, and often putrid matter; hair growing from the lining membrane (which partakes of the character of cuticle); or loose hairs; bone or teeth—these have no peculiar affection for locality, are most capricious in their selection of spots for habitation, and may be found in any part of the mouth or its immediate neighbourhood. They are usually round, small, and, if immediately under the mucous membrane, appear like a white marble em-

bedded in the areolar tissue. Their inclination is to grow slowly; so slowly in some instances, that years may elapse before their presence occasions inconvenience. These may all be of the congenital variety. Mucous cysts, ranulæ, cysts of the lips connected with portions of solid or glandular growth, some serous cysts, and those generally single, will be found to commence after birth, and at different ages. They usually occur before very advanced life.

Solid growths of the lips and mouth, of a non-malignant, *i.e.* non-cancerous character, are not of many kinds, nor do they frequently occur. Labial glandular tumours have already been referred to. Occasionally a fatty tumour grows among the muscles of the tongue, or about the floor of the mouth. The diagnosis is usually simple, though when deep-seated it may puzzle the Surgeon, until he cuts down upon the growth. Its tendency is generally to protrude towards the skin, rather than towards the mouth; the constant movements of the tongue being usually sufficient to direct the mass towards the least resistant surface.

A fatty tumour need only be removed when of an inconvenient size. A free incision over its surface, below the jaw, will generally allow of its being readily dissected or dragged out. The author removed one for a lady, forty years of age, who had been aware for some years of its existence, under the tongue and jaw, on the left side. On cutting freely down upon it, the lobes of fat were found to dip deeply into the floor of the mouth, round the mylohyoid muscle; but the whole was readily removed.

The chief danger attendant on such an operation is extension of inflammation and suppuration to the intermuscular tissue about the root of the neck. The lady alluded to, had for some days considerable pain and difficulty in swallowing, but ultimately recovered.

A solid mass is sometimes observed in the floor of the mouth, of a calcareous consistence. Such a mass is often contained in one of the salivary ducts; it is but a salivary calculus. Occasionally, from neglect or indifference, one has been known to acquire a size, which would be usually considered an intolerable nuisance, and a source of constant disturbance to the patient's comfort. It can be readily removed by a slight incision over it through the mucous membrane.

The condition, in infants, known as "tongue-tied" requires a short notice. Anxious mothers are apt to imagine that this condition exists much oftener than is the case, at least to the extent which, strictly speaking, deserves the name. It is a very unusual congenital defect, to find the whole length of the tongue fastened down by the frænum. The frænum does, however, occasionally run to the apex of the tongue, the lower margin being attached to the floor of the mouth close up to the gums. It is then thicker and more opaque than natural, and considerably restricts the movements of the tongue. It is often supposed, by the attendant nurse, to impede the infant's efforts to draw the nipple, though of this fact we have never been able to satisfy ourselves. If the part be not interfered with, but left to the efforts of nature, within a very few days a small perforation generally occurs in the membrane, and gradually ulcerates forwards, until

the tongue is set free to its natural extent. Should the membrane be very thick; or there be not this tendency to give way; or to appease the mother's fears that the child may not be able to imbibe sufficient nourishment to sustain life, or that hereafter it will be unable to articulate clearly; the Surgeon may relieve the tongue by a slight incision through the anterior margin of the membrane. A little care is requisite in this apparently simple operation. The child should be laid on the nurse's lap, and the operator stand at the head; two fingers of the left hand should be introduced into the child's mouth, one on each side of the tongue and below it, that the frænum be stretched between them, and then the membrane *slightly* divided with a pair of *blunt-pointed* scissors, nearer to the floor of the mouth than to the under surface of the tongue. By this latter precaution, all chance of wounding the ranine branch of the lingual artery is avoided. A mere snip through the free margin will be all that is requisite; the action of the tongue will complete the operation. The less the Surgeon does, the better; a very little loss of blood in an infant is a serious matter, and much more blood may be lost than is either desirable or safe, if the membrane be freely cut; for, in addition to any tendency there may be to hæmorrhage from division of a small vessel, the infant is apt, by a sucking action, to draw upon the wound, and thus encourage bleeding. If hæmorrhage should continue, it would be best at once to pass a double ligature, on a curved needle, through the wound, and then secure each thread, so as to command the bleeding points. Should no vessel be known to have been divided, but the face of the infant become bleached, the wound must be immediately looked to, and any bleeding at once checked by the measures recommended.

TUMOURS OF THE JAWS, AND THE OPERATIONS FOR THEIR REMOVAL.

There are few points in Surgery which require more careful consideration, in order to arrive at a correct diagnosis, than the variety of tumours which affect the upper and lower maxillary bones. We propose to consider these tumours in the following order, viz.:

- | | |
|-------------------|---------------|
| 1. Cartilaginous. | 5. Osscous. |
| 2. Cystic. | 6. Vascular. |
| 3. Fibrous. | 7. Cancerous. |
| 4. Myeloid. | |

The operations for the removal of tumours of the jaw form the subject of subsequent consideration.

Cartilaginous tumours of the bones of the face are rare, and the upper and lower maxillæ may be said to be almost free from their attacks. Mr. Paget alludes to but one well-known case, which occurred in the upper jaw of a patient in Guy's Hospital. Mr. Beaumont, Professor of Surgery in the University of Toronto, has recorded an interesting case in the *Royal Med. and Chir. Transactions*,* which occurred in a boy seven years of age, affected the lower jaw, and was successfully removed.

In the Museum of the College of Surgeons is a wonderful specimen of one of these tumours, which implicates the greater portion of the lower jaw; it had been some eight years growing, and when the patient died, exhausted by its ravages, it measured two feet in circumference.†

The symptoms and prognosis of enchondroma are the same, when it affects either of the jaw-bones, as in other parts of the body. These tumours of the jaws may be removed with much confidence of relief. The operation cannot be too early decided on; delay may be so far dangerous, that a very rapid growth, by a short postponement, may really make the operation very severe and extremely hazardous.

In the removal of the smallest cartilaginous tumour, care should be taken that every particle of the surface of the bone from which it is growing be freely removed. In the removal of the larger tumours, it will depend on the involvement of the bone, how much of it has to be removed. The greater portion of one side, or even the whole, of the lower jaw, or the whole of the upper maxillary bone, if involved, must necessarily be taken away. The disease will probably be restricted to one side in the upper jaw; in the lower, it may more readily involve the greater part of the bone. The prognosis after operation is usually favourable; but it should not be overlooked that enchondroma sometimes recurs, and that in other cases the tumour grows rapidly, and large cysts are developed in its substance.‡ Both these forms of enchondroma approach in character to cancerous tumours.

Cystic tumours of the jaws are not very uncommon. We under-

* Vol. xxxiii. p. 243.

† Museum Catalogue, no. 1034.

‡ See Stanley, *Diseases of the Bones*, p. 268; DISEASES OF BONES, vol. iii. pp. 686, 7.

take their consideration in this place, in order to mark particularly the distinction which must always, pathologically, be made between the secondary cysts of bone resulting from degeneration of cartilaginous tumours, and the primary cystic tumours which attack the upper and lower maxillæ. The latter are seen to originate in the substance or from the surfaces of the jaw, under a variety of unexplained circumstances.

Cysts of the jaws are sometimes found to be connected with a diseased condition of a tooth-fang; or, more frequently, with a diseased action attendant on the development of the tooth-pulp—"dentigerous cysts." (See p. 32.)

Specimens of simple primary cysts of the jaws, commencing in the substance of the bone, may be found in some of the museums of the metropolis. They expand the bone more or less, so as to take with them portions for their outer covering or walls, the remainder of which will be generally made up of a tough membranous substance. The contents are fluid, serous, or gelatinous, and of different shades of colour. "This disease is usually of slow growth; and there have been instances in which the tumour of the jaw, formed by it, has acquired a large size."*

In the Museum of St. George's Hospital may be seen a preparation, which well illustrates the prominent features of a simple cystic tumour of the jaw. The tumour was removed from a woman forty-five years of age. It occupied on the right side the situation of the lower jaw, and extended from the second incisor to the condyle of the bone: it formed a large globular cyst, which occupied nearly the whole of the side of the face. It extended downwards over the upper portion of the neck; and inwards, displacing the tongue; it greatly interfered with speech and mastication. The principal part of the growth was upwards and outwards towards the malar bone, which was somewhat expanded and partly absorbed. In some parts the tumour appeared of bony hardness; in others very elastic. The integument covering it was not discoloured, and there was no enlargement of the neighbouring glands. The disease had been noticed about eighteen years before admission, when it formed a small hard incompressible lump, just over the angle of the jaw: it gave no pain; and for a long time its increase was extremely slow. About six months previous to her admission, it commenced to enlarge very rapidly. The cyst may be seen in the preparation† to extend from the symphysis to the right condyle. The parietes are partly osseous and partly membranous. The entire substance of the jaw-bone on this side has disappeared, and is replaced by the foreign growth. When removed, the cyst appeared to be divided into several cells, which contained a transparent gelatinous fluid; though in the dried preparation there are but few indications of such divisions. The tumour was successfully removed; but the patient died subsequently from pyæmia.

In the Museum of the College of Surgeons there is a specimen of a cyst of the lower jaw, occupying the greater extent of the right side, and projecting outwards rather than upwards. It is oval in shape, and multilocular;

* Stanley, *op. cit.*, p. 267.

† St. George's Hospital Museum, series ii. no. 150.

the cells were filled with a glairy fluid. The diseased portion of the jaw was successfully removed.*

Whatever the origin of these cysts, they appear, on the one hand, independent of any tooth-irritation; and, on the other, of any previous cartilaginous deposit. The diagnosis in such cases is not beset with much difficulty; and even if a doubt exist as to the nature of the tumour, it is at all times safe and easy to explore it with a fine trochar.†

In the treatment of these tumours, it is a milder and a more justifiable course to make a free incision into the cyst, and subsequently to trust to reparative action, than at once to have recourse to removal of the diseased mass.

If the cyst be large, or even if it be ultimately requisite to remove it in its entirety, the previous incision will in all probability have much reduced it in size; when the parts, if not in a better, will certainly be in no worse condition for removal. In both the cases related removal of the tumours was accomplished without difficulty. Two cases are mentioned by Mr. Paget, in which incisions were employed successfully; but in neither case did the bone appear diseased.

In all cystic diseases of the jaws, careful examination should be made of the teeth of the corresponding jaw; all diseased ones near the growth should be at once removed. One of the most frequent causes of serious mischief, and still oftener of exquisite suffering, is the too long abode of defective and decayed teeth in their sockets. We feel satisfied that the greater the experience in the treatment of diseases about the mouth, the more exacting will the Surgeon become respecting the rejection of all useless, defective, or decayed teeth or stumps.

Fibrous tumours of the upper and lower jaw are by no means uncommon; and in their general features, in their growth, and in their varieties, correspond to fibrous tumours of other parts. "The favourite seats of fibrous tumours of bone and periosteum are about the jaws."‡ Such tumours may originate in the substance of the bone, and in growing, expand it, as a crust, over the outer surface of the tumour. In the Museum of the College there is a preparation showing a fibrous tumour of the jaw, with a thin shell of bone over it.§ They may grow from the periosteum, and

* Museum Catalogue, no. 1033.

† M. Giraudeau has described a form of cyst in connexion with the upper jaw, which he believes to be of very common occurrence, and to be formed by a morbid change in mucous glands naturally existing in the lining membrane of the antrum of Highmore (see his *Recherches sur les Kystes muqueux du Sinus maxillaire*); but no such origin can be ascribed to those which distend the body of the lower jawbone in the manner above described.

‡ Paget, vol. ii. p. 145.

§ No. 1045.

imbued the bone in their surrounding mass. They affect equally the upper and the lower maxilla. They may appear early in life. Mr. Liston removed a large fibrous tumour of the upper jaw, in a woman twenty-one years of age, which had made its appearance four years previously.* It grew on the outer side of the jaw, and was removed six months after its first appearance, when about the size of the end of the thumb. In eighteen months, a return of the disease, the size of a hen's egg, was removed, with a portion of alveolus. The growth reappeared in two or three weeks, and attained a large size in two years, which rendered necessary the removal of the whole of the superior maxillary bone. The patient recovered.

Fibrous tumours of the jaws are usually of rather slow growth; but their growth may in exceptional cases be somewhat rapid. Their usual history is one of progressive and persistent increase; perhaps more rapid in proportion to their increase of size, but, in the main, rather slow than rapid. The size some will attain is best illustrated by the collections in our various museums; and especially the preparations collected by the late Mr. Liston, now in the possession of the College of Surgeons. In some respects, as to the size which they attain, they appear to vary from fibrous tumours of other parts, and especially those of the uterus; for fibrous tumours of the jaws are not usually seen to expend their energies in growth; they are not seen to stay their course, to degenerate, or calcify; or perhaps something may be said to depend on their position, for this is such, that it can never permit of sufficient increase, or life, to attain that end, without first having grown to such a size as would occasion a fatal impediment to deglutition, or respiration. They are usually painless in their growth, and innocent in character, as compared with cancer; but their locality, as they grow, renders them formidable as to disfigurement, as to discomfort, and even ultimately to life, if they be not removed before such growth be attained. It is wise, therefore, to pass the verdict of early removal, when we are called to sit in judgment on such cases; the earlier the operation is performed, the less formidable will it be. We cannot hold out a prospect of arrest; but we may certainly forewarn as to the inconvenience of delay, and we may positively predict danger from increase.

In their structure, we cannot point out any distinction between the fibrous tumours which attack the lower, and those found connected with the upper,

* Museum of College of Surgeons, no. 1046.

jaw ; but, practically, there are some important considerations connected with the history of the latter, to which we would especially draw attention ; and a knowledge of which is most essential to any operator dealing with such cases. Fibrous tumours of the lower jaw are invariably more or less globular in form ; usually they have a uniformly smooth surface ; their tendency is to protrude externally, more than towards the mouth : if originating in the substance of the bone, perhaps they may be found equally surrounding it ; if originating in the periosteum, perhaps most prominent on the corresponding surface. Fibrous tumours of the upper jaw are often far different in their outward character, in their surrounding relations, and in the tendency they display, from position, to spread in different directions. A fibrous tumour supposed to be attached to the upper jaw, may really have its origin from the base of the skull, the sphenoid, or the ethmoid bone ; and from either point make its way through the various foramina and fissures, and into the various fossæ in and around the superior maxilla. Instead of a globular dense mass, as in the lower, the tumour of the upper jaw may be lobulated ; or, from its very position, and as a result of its insinuation into these fissures and fossæ, it may be moulded, as it were, into a mass of pedunculated bodies, somewhat analogous to the growing roots of a tuberous plant ; or commencing in the interior of the antrum, it may by growth or position be pressed through its anterior wall, and puff out the cheek ; or through its floor, and push down into the mouth ; or into the nares, and plug up the lachrymal duct ; or into the orbit, and displace the eyeball ; or into all or several of these spaces, and produce corresponding deformity. So that the diagnosis of the origin of a fibrous tumour of the upper jaw is often as complicated an affair as that of the lower is easy ; indeed in some cases, until the upper jaw be removed, it will be impossible to determine to which portion of the skull, or bones of the face, the growth may be attached. The following case illustrates the force of these observations. A man twenty-five years of age was admitted into St. George's Hospital, under the care of Mr. Prescott Hewett, " with a large tumour, of an irregular shape, occupying various regions of the left side of the face." In the cheek, it formed a swelling of the size of a turkey's egg, and filled up the greater part of the superior maxillary region ; the outline of the bone was perceptible to the touch in a few places only ; the zygomatic arch was much more prominent and more curved than natural, having been pushed forward by the tumour, portions of which could be felt under the temporal muscle. The diseased structure was also found, in the shape of small flattened bodies, at the lower part of the orbit, lying immediately underneath the conjunctiva, and apparently quite movable ; the bones of the inner and outer walls of this cavity, as well as those forming its circumference, were not affected or displaced ; but it was impossible exactly to make out the state of the bones at the lower wall, owing to the tumours which were there ; the eyeball was not more prominent than natural. Portions of the morbid growth were detected in the left nasal fossa, from whence a small round mass projected slightly, at times, into the pharynx. The tumour overlapped the front part of the alveolar process, and projected beneath the lip.

About six years previous, the patient had observed, what was supposed to be a polypus of the nose, which was easily removed ; but some little time after, the cheek began to swell, and gradually the tumour commenced to show itself in the various other positions described. Its growth was painless throughout. A year previous, caustic had been freely applied, with the idea of destroying it ; and two large cicatrices marked the places of its action. At various times, there had been extensive bleeding from the nose ; these bleedings had somewhat reduced the patient, who was of a spare habit and pale ; this paleness being attributed to a loss of blood, which occurred shortly before his admission. It was decided to remove the tumour by the usual incisions for the removal of the upper jaw. The bones having been divided with cutting forceps, the superior maxillary and malar were easily tilted out of their place ; when it was found that the disease was not connected with

the upper jaw, but was behind it. The greater portion, which was in view, was removed; some portions were lying in contact with the pterygoid process; some portions imbedded under the temporal muscle; other portions in the orbit. Before the operation could be completed, the patient became so faint, that it was found impossible to proceed with the operation, and he subsequently sank.*

The preparation of the parts shows the superior maxillary and malar bones, and portions of the tumours extracted from behind them; the bones are healthy, but altered in shape from pressure; the tumours present all the characteristics of fibrous structure. The parts removed after death show a morbid growth, originating in the root of the left nostril, and especially on the inner edge of the pterygoid process and under surface of the body of the sphenoid bone, to which parts small portions of tumour were found still attached. The sphenoidal sinuses were filled with diseased structure of a similar character, and were very much dilated; so much so, that at one point the bone had altogether disappeared and left a small hole, where the tumour was lying in contact with the dura mater. A small portion of the growth was also found at the upper and back part of the septum nasi, which was forced over to the right side and partially destroyed by absorption: here the mucous membrane was somewhat thickened; and there was a small pendulous body, loosely connected to the velum palati, and hanging by the side of the uvula. Small flattened growths of a similar nature, and of a bulbous shape, were found deeply imbedded in the spheno-maxillary and temporal fossæ, as well as at the back part of the orbit. None of them had any attachment to the bones; they were all connected to each other, and to the growths in the nostril by a slender pedicle, which passed in the direction of the spheno-palatine foramen; the growth in the orbit had reached that situation by creeping through the spheno-maxillary fissure. The bones of the orbit were quite healthy. The preparation is in the Museum of St. George's Hospital.

The removal of a fibrous tumour with the entire portion of the jaw with which the growth is connected, does not necessarily insure an immunity from recurrence. Two specimens in the Museum of the College of Surgeons illustrate the reproduction of a fibrous growth, subsequent to the removal of a previous one. One preparation shows the right side of the lower jaw, from the angle to the first bicuspid tooth, with a tumour of a fibrous character, two inches in its greater diameter, and situated entirely on the anterior surface of the bone, and extending along nearly the whole portion removed. Its base is osseous, and the rest fibrous.† The other shows the ascending ramus, condyle, and coronoid process of the lower jaw, with a tumour of a similar character.‡ A woman thirty years old had suffered from "toothache" from nine years of age, after a blow on the cheek. The first portion of the jaw with the tumour, was removed about five months after it was first observed; its growth had been painful, both in the jaw and the cheek, and was attended with constant headache. No portion of the disease was apparently left at the first operation. But the disease re-

* *Med.-Chir. Trans.* vol. xxxiv, p. 43.

† No. 1041, College Museum.

‡ No. 1042, *ibid.*

appeared at the ramus, which was subsequently removed at the joint. The patient recovered.

Subject to this occasional tendency to recurrence, fibrous tumours may be classed as essentially innocent; largely so, in proportion to many of those which affect the jaws; if by the term innocent we intend to convey the possibility of complete eradication by operation, and, subsequent thereto, a total immunity of the part and the system from recurrence of the disease.

And yet, as in other parts, so in these, we must be prepared to meet with fibroid tumours which present many of the characteristics of true fibrous growths, but possess in addition the peculiar property, that upon each removal there appears a more rapid tendency towards recurrence, as well as greater rapidity in growth: from the true structure of fibrous tissue, as each removal takes place, there is a gradual shading off into fibro-plastic or mere gelatinous tissue; until at last rapid growth and rapid deterioration of constitution run hand in hand, and the patient sinks, exhausted by a foul ulcerating sore based on a monstrous fungoid mass. When cut into, this mass presents a smooth, gelatinous, and somewhat elastic surface; the structure abounding in serosity, and often readily broken down; void of many blood-vessels, and of a low vitality.

Fibrous tumours of the jaw may be partly composed of bone; or partake of a fibro-cellular character, such as we find in similar tumours of other parts of the body. In the Museum of St. George's Hospital is a preparation showing, on section, a small nucleus of bone which in no part approaches the surface of the tumour.* Another specimen shows much bone radiating into the substance of a fibrous tumour from its base, and approaching in some parts very near the surface.

Fibrous tumours, usually of slow and painless growth, are often attended with suffering when they affect the jaws; and their growth may be sufficiently rapid to require the aid of the Surgeon within a few months of their outset, to obviate the serious results of pressure and encroachment on the cavity of the mouth.

"As a general rule," says Mr. Paget, "the vascularity of a fibrous tumour is in inverse proportion to its singleness and toughness of construction."† Yet, in the region of the mouth, we constantly observe a tendency to recurring hæmorrhage; perhaps to be attributed in some measure to the friction the surfaces may be subject to, or the accidental bruising they may receive, in the daily process of mastication. This hæmorrhage is not usually very great at any one time; but it has this important practical bearing, that by its amount or by its frequency it deprives the patient of much blood; he becomes blanched and reduced; and if relief be long deferred, he becomes little capable of undergoing an operation, which of itself often exacts the immediate loss of a large amount of blood. A case already related points to the principle here enunciated.

Myeloid Tumours of the Jaws. What has already been said relative to the general features of fibrous tumours originating in the jaws will to some extent apply to myeloid tumours affecting these bones. They will perhaps be found to affect those parts almost as frequently as the fibrous tumours. The Museum of St. George's Hospital contains specimens sufficient to mark that myeloid growths, connected with the maxillary bones, are not rarities in surgical pathology.

* Series ii. no. 155.

† Op. cit. vol. ii. p. 134.

The general characteristics of these growths have been well summed up by Mr. Paget. "Myeloid tumours," he says, "usually occur singly; they are most frequent in youth, and very rare after middle-age; they generally grow slowly, and without pain; and generally commence without any known cause, such as injury or hereditary disposition. They rarely, except in portions, become osseous; they have no proneness to ulcerate or protrude; they seem to bear even considerable injury without becoming exuberant; they may (but very rarely) shrink, or cease to grow."*

A specimen in the Museum of St. George's Hospital shows a tumour about the size of a nut, with a portion of the whole depth of the lower jaw, which was removed from a girl eight years of age. Four and a half years after, she remained well.† Mr. Caesar Hawkins removed a tumour of a similar nature, with a portion of the alveolus of the upper jaw, from a little girl five years of age, in St. George's Hospital. This had grown rapidly in the course of about three weeks, and was successfully removed.

The diagnosis of a myeloid tumour is always uncertain until microscopical examination of its structure has been obtained. The general disposition has already been fully described by Mr. Paget. In its origin and growth, in connexion with the jaws, it may be mistaken, as in all other parts which it attacks, for cartilaginous or fibro-cellular growths. Its characteristic features are most marked in its intimate structure; for an account of which we refer the reader to the essay on TUMOURS, vol. i. p. 491.

The nature of myeloid tumours of the jaw permits of no half measures in treatment; entire removal of the growth, with the portion of bone to which it may be attached, is the only safe, the only justifiable course to be pursued; and no delay should be recommended or sanctioned. As it will surely grow large when once started, it should without hesitation be removed whenever detected. The removal does not always ensure safety. There is no doubt that myeloid disease is sometimes recurrent. The experience of late years has fully established this fact.

Osseous tumours of the upper and lower maxillæ are not very commonly met with, but occur sufficiently often to make them especially interesting, in connexion with the surgery of the mouth. They will be found to occur in two different forms or characters:

* Op. cit. vol. ii. p. 217.

† Series ii. no. 168.

simply as out-growths from the parent bone, to which a base more or less narrow or broad is attached; or as a general thickening and enlargement of a part, or of the entire bone, terminating often in considerable and frightful malformation.

The true osseous tumour is often compact, heavy, hard, and ivory-like on section; or else more spongy or cancellous, much less hard, and much less weighty in proportion to its size. Practically, the size, the rapidity of growth, and the locality, are of more importance than the exact condition of its structure.

Osseous tumours are seldom rapid in growth; they may affect any portion of the jaws; they are not usually painful, but generally and steadily increase in size, and sooner or later their removal is rendered imperative.

In the Museum of the College of Surgeons is a preparation which shows the true character of the hard ivory-like tumour of the jaws. It is seen growing from the angle of the lower jaw, to which it has an attachment by a broadish base.* Another similar specimen may be seen in the Museum of St. George's Hospital.† The removal of these out-growths, whether they implicate the upper or lower jaws, presents no greater difficulties than does the removal of fibrous or other tumours; excepting, that if deeply nodulated and irregular on the surface, they may be entangled in the fibres of the adjacent muscles, and require much careful, it may be tedious, dissection, before they can be cleared from the surrounding soft parts.

There remains to be considered the other condition referred to, in which the bones of the face, or any portion of them, take on a peculiar process of growth, thickening, and occasionally great enlargement.

The Museum of the College of Surgeons contains specimens illustrative of this diseased action in bone, and they demonstrate what an amount of hideous deformity may occur in the victims of this horrible disease,—horrible inasmuch as it appears perfectly beyond the control of medical treatment; and unless seated in a part readily removable, entails on the wretched sufferer a lingering malady which, though slowly, yet surely, in most cases, continues its growth until its mechanical interference with the process of deglutition, or some other complication, causes death.

The tendency of this disease appears to be, that it does not restrict itself to one bone, or one portion of a bone; but that several

* No. 1035.

† Series ii. no. 191.

bones contiguous to each other may become affected in their turn, and to such an extent that all surgical interference would be quite out of the question. If, however, the disease be confined to one portion of the face, such as the lower jaw, or the antrum, it may probably be relieved by operation.

This diseased action may be set up in very early life. A case is related by Mr. Paget, in which Mr. Stanley removed the superior maxillary bone in a girl, fifteen years of age, in whom the swelling had been observed to commence eight years previously.

With respect to treatment of osseous tumours generally, it will be found, as a rule, that neither local applications nor constitutional measures appear to arrest, or destroy their growth. It is but a waste of time, and trifling with the patient's confidence, to suggest any thing but the entire removal of the tumour. Of course this recommendation will depend on the amount of bone implicated by the disease; but if the mass can be *entirely encompassed* by the knife and saw, and the operation be otherwise practicable, the removal of the tumour is most likely to be perfectly satisfactory in its results. "It may be stated," says Mr. Stanley, "that absolute security against the reproduction of an exostosis can be obtained only by the removal of every part of its circumference. If but the smallest portion of the exterior of the exostosis, with its cartilaginous capsule, be left, reproduction of the tumour will be, at the least, not an improbable occurrence."*

Experience has fully confirmed the observations just quoted; and the caution which they inculcate is, not to attempt the removal of a portion, when the whole mass of an osseous tumour may present obstacles to its entire resection. How far the hypertrophied condition of bone may hereafter prove to be subject to constitutional treatment, is a fair question of experiment. The disease is not common, and opportunities are few in which the efficiency or benefit of drugs, externally or internally, can be fairly tested. The disease has certainly something more of a constitutional character than simple osseous outgrowth, and the condition is one which has been known occasionally to assert the prerogative of hereditary transmission. In reference to treatment, Mr. Stanley states, "that medicines have no influence upon the disease."

In their removal by operation, there is an exception to the rule which applies to osseous tumours, that the whole of the

* Stanley, on *Dis. of Bones*, p. 157.

disease must be removed; for when the deformity is the result of hypertrophy, if the whole mass is beyond removal by the Surgeon, even a portion may be cut away with present if not permanent benefit. "I know, in cases where only part of the hypertrophied bones have been removed, the wound has healed soundly over the remaining portion of them; and it has not in such instances appeared that the operation was followed by any increase of the disease."*

Vascular tumours of bone are so rare, and of the jaw so few instances have been put on record, that we even venture to express some hesitation in taking for granted, that those described may not have been tumours of a cancerous nature. The entire removal of the disease is the only treatment to be recommended. As described, the disease appears to commence in early life, and to be painless; but its external characters are such that no very accurate opinion can be formed of its nature, unless it present on the surface the deep-red colour produced by enlarged vessels.

Cancerous tumours of the maxillæ, and cancerous ulcerations of the gums, remain to be considered.

Cancer of the bones of the mouth is by no means uncommon; it is generally of the medullary form, occasionally of the osteoid variety. Cancer of the gums is more rigidly confined to the epithelial character. Scirrhus, in its onslaughts, appears to disregard these regions; for though found as a secondary condition in bone, it has not fallen to our lot to notice it in the bones of the face; the experience of others confirms this observation.

Cancerous growths are observed more frequently to affect the superior than the inferior maxilla, and to commence most frequently in, or around, the walls of the antrum. The history during life, and the anatomy, of medullary and osteoid cancers of bone, written elsewhere in this work, apply in every minute particular to the origin, the growth, and the structure of cancers affecting the bones of the face. It is not, therefore, requisite to enter now into a minute examination of their constituents; our remarks will embrace the chief practical features to which the attention of the Surgeon should be directed, so that a correct diagnosis be arrived at, and prompt measures adopted where necessary.

Age is no criterion, in the diagnosis to be formed, respecting a cancerous tumour of the mouth. We observe the disease in children, in persons of middle life, in the extremes of old age. It

* Stanley, on *Dis. of Bones*, p. 5.

commences often without pain, but it rarely progresses without suffering; and in many instances the pain of cancer affecting these bones is one of unmitigated torture. The external appearances of these tumours differ in many ways, and much in each case.

When the disease is confined to the lower jaw, its character may be more readily and earlier detected than in the upper. If medullary, it displays a softish pulpy mass, more or less elastic; projecting, it may be, on the outer side, and bulging out the chin or cheek; or on the inner side, and pushing down towards the throat; or it may uniformly surround the bone.

A case illustrative of the latter condition was (1863) in St. George's Hospital, under our care. It was rapidly running its course. The patient, a man *æt.* 46, observed a swelling on the outer side of the lower jaw four months previous to admission. The tumour rapidly increased, and, on admission, involved the bone, from the symphysis to the first molars on each side. It projected backwards and downwards to the hyoid bone. The skin over it was stretched, and partially adherent, especially at the lower and left side, where it was thin, soft, red, and pulpy; much as if the disease had nearly made its way to the surface. Some of the teeth on the left side were becoming prominent and loose. Under such conditions, it was thought best not to interfere by operation. The patient died about three months after his admission.

Occasionally the masses which project into the mouth run early into ulceration, discharge very offensive matter, and often have a ready tendency to bleed. If teeth become loose and are removed, a fungoid growth shortly fills the vacant alveolar sockets. The external parts, if the tumour project in their direction, appear soon to become thoroughly implicated in the growing mass; the skin becomes bound down to the parts beneath; it becomes darker coloured, dusky-red, or purplish; brawny, uneven, and puckered, with soft round knobs projecting outwards; and ultimately ulcerated, when rapid destruction of structure sometimes occurs from sloughing. A foul excavated and irregular sore is thus produced. The neighbouring lymphatics frequently bear evidence of the constitutional contamination; and the cachexia of cancer is usually well marked.

When the upper jaw is the seat of cancerous growth, there is often, in its early stage, some difficulty in arriving at a correct diagnosis as to the nature of the tumour. It is often but little exposed to view; it may be entirely imbedded in an osseous chamber; or compressed and moulded by osseous walls, which, in the commencement, retard or direct the course of its growth. It may project into the nostril, block it up, and, perforating the septum, pass through to the opposite side; it may commence in the anterior wall of the antrum, and project forwards under cover of the cheek; or from the outer wall, and proceed downwards over the alveolus, and upwards into the temporal fossa; or from the interior of the

antrum, and make its way uniformly into the nares, into the mouth, into the orbit, outwards, and forwards, and backwards. As it grows, the bones adjacent to it become expanded to some extent; then implicated or absorbed. If it presses forwards, the cheek and upper lip become distended and puffy; the fungoid growth within increases, and protrudes sometimes, at the angle of the mouth; the eyelids become œdematous, and by degrees are closed; or perhaps, prior to this, the eyeball is pushed forwards or outwards; and the cornea, no longer covered by the lids, ulcerates or sloughs, and the contents of the globe escape. Nothing can be more hideous than the advanced condition of a medullary cancer of the upper jaw, presenting often a mass half as large as the head itself; ulcerated or sloughy on its surface; discharging horribly stinking pus, mixed with blood; and persecuting the sufferer with unabating, and often agonising, pain.

Rapidity of growth is a strong point in the chain of evidence which is to decide the character of such tumours. But we have already observed, that rapid growth is seen occasionally in tumours of a non-malignant character. In medullary tumours, rapid growth is the rule; early attainment of size a marked feature; and the rapidity of growth commensurate with increase of size. The constitutional deterioration also is continuous. The early contamination of the skin with the tumour should surely point out to the Surgeon the extreme foolhardiness of attempting to remove a mass of disease, the extent of which it is almost impossible to define; and, consequently, the satisfactory removal of which is rarely practicable, with due regard to the patient's benefit. To illustrate the various points herein put forward, and to mark especially the difficulty of obtaining a satisfactory insight into the origin of such growths, as well as to indicate the utter hopelessness of attempting to remove many of them by operative interference, we wish to draw particular attention to the two following cases: We were consulted by the parents of a child, L. C., æt. 5, suffering from a tumour, supposed to be connected with the upper maxilla of the left side. The left nostril was filled up and pushed outwards; the soft palate was much pressed downwards, and a portion of the tumour could be seen at its lower edge. Some attempts had previously been made to drag away the mass; but upon each occasion alarming hæmorrhage occurred. As the disease was evidently medullary cancer, increasing rapidly, and there was great uncertainty as to its origin, it was recommended that no operation should be permitted. The child died within two months of our first visit.

The face was greatly disfigured, by considerable protrusion of the left eyeball outwards and forwards, by the expansion of the nostrils, and by the projection of a fungoid mass from the left one.

The dura mater, between the sella turcica and the ethmoid bone, was thickened on its attached surface, and readily separated from the bone. The corresponding portion of bone, as well as the cribriform plate and crista, were more vascular, darker coloured, and less compact in structure than natural. The nostrils were filled with a whitish medullary tumour. It had projected in front to such an extent, that it had separated the nasal bones and cartilages some distance from each other. Inferiorly, it had partially protruded through the anterior orifice of the left nostril, and had separated the palate processes of the superior maxillæ and palate-bones, sufficiently to admit the point of a finger between their edges. The septum nasi was absorbed to a great extent; also the inner walls of the orbits; and thus the tumour pro-

jected into the cavity of each orbit, occupying the whole of that of the left side, where it had pushed the eye-ball outwards, on a level with the anterior orbital margin. The tumour had also penetrated into each antrum. Posteriorly it had passed through the openings of the posterior nares; was in close contact with the under surface of the basilar process, and the anterior surface of the upper cervical vertebræ; pressed down the soft palate considerably; and had extended into the pharynx, almost as low as the epiglottis.

The above case illustrates the progress of medullary cancer of the upper jaw in childhood; the following shows how similar are the conditions in more advanced life; and both show how in each the Surgeon would be foiled in any attempt to remove them. A woman *æt.* 50 was admitted into St. George's Hospital in July 1861, under the author's care, for a tumour apparently growing from the antrum, and involving its anterior wall and the hard palate. Five months previous she had a decayed tooth removed from the upper jaw, for pain on the left side of the face and head; immediately after which the gum enlarged, and an abscess which formed was opened, when the escape of about half an ounce of pus took place. The opening closed; but as the swelling returned, it was again lanced two days after; but on this occasion no pus escaped. From that time the swelling continued to increase, and now presented a prominent mass over the antrum and in the mouth, both in front of the alveolus and through the hard palate. The tumour grew very considerably. She suffered excessive pain. The eye, pushed forwards, became opaque, and sight was soon completely destroyed; deglutition also was difficult. She died about ten months from the commencement of the disease.

The skin was not implicated in the growth. The bones surrounding the mass were so soft, that they were readily cut with a scalpel. The tumour projected largely into the mouth; it involved the palate, the inferior turbinated, the ethmoid, the sphenoid, and the superior maxillary bones. Through a portion of the ethmoid and sphenoid bones there was an opening communicating with the cavity of the skull. The growth, with the portion of upper jaw that remained connected with it, is in the Museum of St. George's Hospital.*

If a cancerous tumour of the lower jaw be seen in an early condition, if it is situated near the symphysis, and the patient desire it, its removal, with the whole depth of the bone to which it is attached, may be attempted; for if situated in front, the limits may be ascertained, and the tumour dissected out entire. But if it involve the bone near the angle, we can seldom ascertain how deeply it may extend, or to what degree it involves, by infiltration, the tissues at the root of the tongue; it may extend far beyond the reach of the scalpel.

After all, it will be found that much discrimination is required on the part of the Surgeon, who has to decide upon the removal of a cancerous growth of the jaws: and so much depends on the individual features of each case, that it would be entirely out of the question to attempt a strict code of directions relative to treatment. At best, however, interference by operation is in the large number of cases most unsatisfactory; in the few, we hope some benefit is conferred.

We cannot do greater justice to the subject than by transcribing, in con-

* The author is indebted to Mr. Charles Hunter for the post-mortem examination.

clusion, the words of Monsieur Giralès : " Dans le traitement des tumeurs du sinus maxillaire, il est des cas dans lesquels le chirurgien doit agir, et d'autres cas dans lesquels il est prudent de s'abstenir. Lorsque les tumeurs sont de petit volume, et surtout lorsque la constitution du malade n'est pas altérée, l'art doit intervenir, et dans ce cas, il peut arrêter le mal pendant quelque temps, et prolonger la vie des malades. Si la tumeur est volumineuse, sans que la constitution du malade soit encore altérée ; si la cachexie cancéreuse n'est pas développée, le chirurgien doit encore intervenir, et par deux raisons : d'abord, parce qu'il peut arrêter pour quelque temps la marche d'une maladie qui a une grande tendance à progresser ; ensuite, parce qu'il peut avoir affaire à une tumeur fibro-plastique dont la malignité, dans le cas où elle serait maligne, serait toujours moindre que celle des tumeurs encephaloïdes. Lorsqu'enfin la tumeur du sinus est volumineuse, qu'elle envoie des prolongements en tout sens, que la constitution du malade est altérée, l'intervention de l'art ne ferait que compliquer un état déjà trop grave."*

The gums and the other soft tissues of the mouth, if affected by cancer, are usually attacked by the epithelial variety. Commencing gradually on the surface of the gums, it runs its course, similar to that species of cancer elsewhere. By degrees the ulcerated surface spreads ; the borders of the ulcer present their usual thickened and elevated edges : not only the cheek, but the floor of the mouth and tongue become secondarily affected. The disease in this situation is generally very painful ; much distress is occasioned by movements of the cheek or tongue ; much misery entailed by constant escape of saliva ; great inconvenience and often difficulty is experienced in articulation and mastication.

No operation in such cases is justifiable. Epithelial cancer affecting the mouth appears to partake of a more malignant aspect than it assumes elsewhere ; or rather, we might say, its local position renders it an obstacle to the requisite supply of food : consequently the life of the patient is sooner terminated. The treatment to be adopted is palliative : locally, the use of gargles, to destroy the distress occasioned by offensive discharges ; constitutionally, anodynes to lull the pangs which constantly dart through the parts affected.

OPERATIONS.

As operations for the removal of the lower or upper jaw, or any portions of them, have been fully described in all treatises on Operative Surgery, we feel that there is nothing new to record in the following observations. Our notice of the diseases of the jaws would, however, be incomplete were we not to lay before the reader the general rules he should observe, and the manner in which he should proceed, when called upon to operate on either of these bones.

Operations in diseases of the lower jaw may involve the removal of but a small portion of the bone ; of a large portion of its anterior division ; of one half—from the symphysis to the condyle ; or rarely of the whole bone, with both articular processes. There is considerable difference in the method of proceeding under these various conditions ; but chiefly as regards the external incisions required in each.

A small tumour may occupy only a portion of the anterior part of the

* *Des Maladies du Sinus maxillaire*, p. 54.

lower jaw, and the growth be found connected with the alveolar edge without affecting the bone to a greater depth ; extending perhaps further laterally than downwards. It may have involved the alveolar process to such an extent, that the corresponding teeth are loose or have been pushed out. A case in which a tumour (fibrous) affected the lower jaw to the extent of the four incisors, came under our care a few years ago. The tumour was firm and painless, and involved about half the depth of the jaw. The canine teeth were removed : a saw was then used to cut down on each side of the tumour, through half the depth of the bone ; then, with a pair of cutting forceps, the upper half of the bone, between the lateral cuts, was taken away, with the tumour still adherent to it. Mr. Fergusson relates a case in which he removed a much larger portion, in breadth, of the lower jaw, by a similar operation.* He justly observes, that the advantages of being able to leave the lower half of the bone are very considerable ; for the lower jaw retains its shape, and false teeth can be readily adapted to it, when the parts are healed. When, under these circumstances, the tumour is small, no external incision is requisite. In the case alluded to, Mr. Fergusson was obliged to expose the tumour, by making incisions from the angles of the mouth to the base of the lower jaw. If the operator can possibly avoid cutting through the lip, he should by all means do so : and it will be found that, by drawing the lower lip down, separating it from the bone, and with retractors pulling upon the angles of the mouth, a considerable surface of the anterior part of the bone may be exposed, without any external incision. Instead of two incisions through the lower lip, when a tumour has to be removed with the anterior portion of the jaw, one incision in the median line may suffice : it can be carried down below the chin without any obstacle or objection ; and this allows the flaps to be drawn well over to either side, so as to expose a considerable portion of the bone. The downward extension of the incision also affords a ready escape for the future discharge from the wound.

When a tumour involves the whole depth of the bone, and this has to be removed with the morbid growth, the external incisions having been made, the flaps must be cleanly dissected from the tumour, to expose a sufficient surface of healthy bone on each side. In order to enable the Surgeon to cut where the tissues are sound, the teeth should be removed where the bone is to be divided. The anterior surface being denuded, the posterior has to be freed from attachments of muscles, &c. Prior to passing the knife behind the bone, the tongue must be secured ; a strong ligature should be passed through its apex, and held by an assistant. Of course this is only requisite when the muscles are detached at the symphysis. If this precaution be neglected, the tongue is apt to fall back on the division of its muscles, and the patient runs the risk of suffocation. The ligature may be removed a few hours after the operation ; in the mean time it should be held by an assistant, or otherwise secured on the face. A large fibrous tumour of the lower jaw was removed in our presence, with more than half of the bone, without any attention being paid to the tongue ; the patient appeared choking, when the tongue was seized with a pair of forceps, drawn forwards, and immediately secured with a needle and thread, and the patient again breathed with comfort. If the tumour be very large, and irregular on its posterior aspect, it is better first to cut through the jaw at its sides, and then subsequently detach it and the tumour from its posterior adhesions. The isolated portion of the jaw can then be turned forwards, and the mass dissected from the soft tissues at the floor of the mouth, commencing within from above downwards. The method of dividing the jaw is simple, if properly performed. The outer shell of the bone should be notched with a fine saw, and then the bone cut through with a pair of strong bone-cutting forceps. When a tumour implicates the side of the lower jaw, or runs near to or involves the ramus, the external incision, to expose the bone, will differ from that described. If it be requisite

* Fergusson's *Practical Surgery*, p. 668.

to disarticulate the bone, the external incision should commence just above and over the corresponding temporo-maxillary joint; be carried down to near the angle; then turned forwards to the side of the chin and (if the tumour extend far forwards) towards the border of the lip, and terminate within a little of its free margin. The integuments of the side of the face included in this line of incision are now to be dissected upwards. The incision has crossed the facial artery; and as the flap is dissected off, the artery must be divided; it had better at once be tied, to save loss of blood. The bone immediately in front of the diseased mass has then to be divided, as described. The portion to be disarticulated must then be seized and drawn outwards; some force may be requisite to effect this. As the bone is drawn outwards, the mucous membrane and muscles are to be detached from its inner surface. The knife has only to be kept in close contact with the bone to effect this, and to avoid all unnecessary danger. As the articulation is approached, the bone should be still pushed forcibly outwards; the point of the knife made to cut close to it, and care taken, in cutting through the ligaments of the articulation, not to let the point be carried inwards, or out of sight. The external carotid or the internal maxillary may readily be wounded, if this precaution be neglected. If disarticulation be not requisite, in consequence of the tumour not extending to the condyle, the external incision need not be carried quite so high on the side of the face; but, in other respects, should be made in the direction just described. The bone, however, will have to be divided behind, as well as in front of the tumour. The remaining stages of the operation are comprised in securing all bleeding vessels, and in bringing the edges of the wound together. Silver sutures are probably most useful here. They should be introduced at frequent intervals, so that the corresponding portions of the side of the face be accurately adjusted to each other. The extreme vascularity of the tissues generally secures rapid union, and a speedy recovery from such an apparently frightful wound. The inner surface of the cheek should be supported with a fold of wet lint. The dissevered muscles soon adapt themselves to their novel duty, and within twenty-four hours are capable of supporting the tongue sufficiently to enable it to perform its usual offices, without fear of its retraction towards the pharynx. The chief inconvenience as regards the portion of the jaw which is left is, that it is apt to be drawn inwards. But if a thin cap of metal be adapted previous to the operation, so that the upper and lower teeth can be secured by it, it may be applied, as soon as the operation is completed, with great advantage. It steadies the parts, and does not interfere with the administration of food. This latter should be fluid, and may easily be sucked in between the lips, without separating the teeth on the sound side. The jaw should be supported by a handkerchief or bandage passed under the chin, and fixed over the head. Formidable as this operation is, patients usually convalesce satisfactorily; nor is the disfigurement, subsequent to the removal of a large portion of the lower jaw, or even the whole bone, so great as might be expected. In men the cicatrix can be partially hidden by whisker and beard; and in women a little artificial ornament will readily conceal the greater part. The material deposited in the situation of the original bone assumes a shape much like that of the jaw itself; becomes firm and fibrous, and able to support a plate with artificial teeth.

If the whole of the lower jaw is to be removed, the incision should extend from one side of the face to the other. Starting from over the articulation, the incision, on arriving at the chin, instead of being carried up towards the lip, should be carried onwards to the opposite angle of the jaw, and then upwards to the condyle. This is a formidable operation. If practicable, considerable facility may be obtained by dividing the symphysis immediately after the exposure of the surface of the whole bone. This step will be found to accelerate, and render much less complicated, the separation of the muscles and soft tissues from the inner surface of the bone and tumour, and especially aid in the more rapid disarticulation of each condyle.

The extensive incision necessary for the removal of a large portion of

the lower jaw unavoidably passes across and divides the larger branches of the portio dura ; the result of which is loss of power over the cheek, and a drawing over of the mouth to the opposite side. This disfigurement, at first, is generally considerable ; but appears usually to improve by time, though it rarely entirely disappears. Mr. Syme succeeded in removing a tumour confined to the ramus of the jaw by a modified incision on the side of the face, commencing over the tumour, and continued down towards the angle, and then forwards, without cutting into the mouth. The ramus, with the condyle, was successfully removed.* During operations for removal of tumours connected with the lower jaw, the patient should sit up rather than lie down. The blood thus escapes externally, more readily than into the throat. Chloroform may be given with safety, but requires to be administered cautiously, with sponge or towel held near the nostrils. We should not do justice to British Surgery did we omit to mention that Mr. Anthony White, Surgeon to the Westminster Hospital, was the first to remove a portion of the lower jaw. In 1804, it appears, he set the example, and thus established the practicability of the operation.†

The operations requisite on the upper jaw vary according to the nature of the disease affecting it, and the extent to which the walls of the antrum are implicated thereby.

Small tumours growing from and involving the alveolar process may be usually removed without external incision, as described in the lower jaw. Cysts of the antrum or gums may be attacked with trochar or knife, by first pushing up the lip, or drawing upon the angle of the mouth. But when it becomes necessary to remove a portion of the superior maxilla, the direction and extent of the external incisions are very important. When the tumour is small, and it is supposed to be limited to the inner surface of the antrum, or projects from thence into the nostril, an incision through the middle of the upper lip into the corresponding nostril, continued upwards from the attachment of the ala for an inch or more along the side of the nose, will enable the Surgeon to dissect off a considerable flap, and uncover a very large portion of the superior maxillary bone.

When it is supposed requisite to remove the whole of the superior maxilla with a large tumour, a second incision to that described will be requisite. This second incision must be carried through the cheek, from the inner surface of the angle of the mouth, obliquely to the prominence of the malar bone ; or if the tumour be very considerable, and implicates the malar bone, the incision can be run outwards over the zygoma ; an ample flap may thus be secured, when the soft parts are dissected upwards from the anterior surface of the bones.

If, when the requisite incision is made, and the bone sufficiently exposed, it should appear that the disease is confined to the inner wall of the antrum, or growing from it into the nostril, the nasal bone should be cut through, and turned partially to one side, without entirely separating it from its periosteal attachments. Thus the nostril will be laid fully open, and the tumour can perhaps be removed without cutting away more bone. If this measure be successful, the nasal bone may be replaced, the flap of skin brought over it, and secured with sutures.

If the disease is found to affect the lower half of the antrum, and the orbital plate is free, then the latter may be left, and the former removed. The incisor teeth of the side affected having been extracted, the alveolus in front should be partially divided with a small fine saw ; the Surgeon cutting from the nares downwards. The cutting-forceps should complete the division of the bone backwards, with that of the hard palate. A line of incision had better first be made along the mucous membrane of the latter, on the side of the median line which is affected by the disease. Then the bone immediately below the margin of the orbit, and from the nostril to the outer

* Syme's *Contributions to Pathology and Surgery*, 1848, p. 21.

† *Med. Gazette*, 1846, vol. ii. p. 529.

edge of the malar bone, must be cut through with saw and bone-forceps, and the attachments of the soft palate separated with the scalpel. The portion of bone to be removed should then be seized with strong forceps, when, by means of a few additional cuts with the knife, the Surgeon will be able to dislodge the lower portion of the maxillary bone, with the tumour attached.

If it be requisite to remove the whole of the superior maxilla, the external incision which extends in the direction of the zygoma must be continued backwards sufficiently to allow of the free exposure of the zygomatic process of the malar bone. When the flap of the cheek has been freely dissected upwards to the margin of the orbit, the floor of the orbit must be cleared carefully of the attachment of the inferior oblique muscle, &c. The zygomatic process of the malar must be notched with the saw; the alveolar ridge similarly treated; and then the bone-cutting forceps employed. One blade of the instrument should be introduced into the nostril, the other at the inner and inferior portion of the orbit; great care being taken that the eyeball is not injured. The blades of the forceps should cut through the nostril and floor of the orbit to the spheno-maxillary fissure; the malar bone should be cut through its middle, right back to the anterior extremity of the same fissure; and the hard palate, on the same side of the septum nasi, should be cut back to the posterior border. Thus the tumour and bone will now only be held by a few attachments of soft tissue, which the knife easily separates. The bone can then be removed with slightly forcible manipulation, or by twisting it in the grip of a pair of strong forceps.

The hæmorrhage in such an operation is usually greater from the flap than from the rest of the exposed surface; but generally subsides in a short time, so that many ligatures are rarely requisite. The hollow left by the removal of the bone should be partially filled with wet lint, and the edges of the flap secured as already described. The patient should sit in the upright position to undergo such an operation, that he may readily get rid of the blood from his mouth. Chloroform should be administered by an experienced person; for its action can only be kept up by its being applied on a sponge or towel.

Tumours of the upper jaw vary so materially in size, in prominence, and direction, in their point of origin, and in many other circumstances, that, in the direction and extent of the external incisions, much latitude must be given, and much left to the judgment of the Surgeon. Langenbeck has described several operations for the removal of tumours of the face. The peculiarity of these operations is, that he has endeavoured to separate the periosteum from the bone (when necessary to remove the latter), and to preserve the former in connexion with the soft parts. He believes, by so doing, that he has obtained recovery without deformity; while, if he had removed the periosteum, deformity would have resulted.

He has also adopted an operation, which he terms osteoplastic resection of the upper jaw. This operation is performed when the origin and growth of the tumour is behind the superior maxillary bone, but cannot be reached without displacing that bone.* Instead of removing the superior maxilla entirely, the requisite external incisions are made down to the bone at once, the bone sawn through in the same incisions, and the portion thus partially detached forcibly turned inwards, without otherwise dividing it from its connexions with the nasal and frontal bone. The tumour is then removed from behind the bone, and the latter replaced in its original position. No incision is made at the place where this fracture or bending must necessarily occur.

Langenbeck's observations, and the cases he records, are too lengthy for us to introduce here; we must therefore refer the reader to the original.†

* As in Mr. Hewett's case, referred to on p. 124.

† *Deutsche Klinik*, 1859, no. 48, p. 470; and 1861, no. 29, p. 281.

DISEASES OF THE PHARYNX AND ŒSOPHAGUS.

Congenital defects of the pharynx are rare, and when they occur are associated with such other conditions of the foetus as to render them incompatible with life; so that no practical importance attaches to their consideration.

Inflammation of the pharynx is generally a continuation of a similar condition of the fauces and soft palate, but is, though very rarely, seen to exist alone. When complicated with inflammation of the fauces and glottis, the inflammation appears to partake of an erysipelatous and diffuse character, and often terminates in purulent infiltration of the cellular tissue.

The general conditions indicative of this form of inflammation have already been considered under the head of œdema of the glottis, vol. iii. p. 228. Difficulty in swallowing; laboured respiration; swelling of the throat, often observed externally; swollen and rounded uvula and margins of soft palate, hiding from view all behind them,—are the prominent symptoms. The tongue soon becomes brown and dry, the lips covered with sordes. The patient soon dies in a spasmodic effort to respire, or gradually sinks. Usually death takes place at an early period, and often sooner than perhaps has been anticipated. A patient, well to-day, is attacked in the evening with sore-throat and difficulty in swallowing; these symptoms are soon followed by great obstruction to respiration, entire loss of sleep, rapid pulse, and hot skin; in the course of three days, or four at latest, with all his faculties clear, and while able to direct by motion or writing those around him, the patient's head falls back, and he is dead.

If the parts be examined after death, there will be found œdema of the sub-mucous areolar tissue, around and in the substance of the constrictors, and travelling down around the œsophagus, as low as the cardiac extremity. Often the areolar tissue is the seat of purulent infiltration. The treatment of such cases is, most frequently, hopeless. As long as the patient can swallow, as long as the mischief stops short of purulent infiltration, there is hope of recovery, and encouragement to persevere with the administration of stimulants and nutritious fluid food, if they can be swallowed; or with enemata of wine, quinine, and beef tea. Laryngotomy should be performed when danger of suffocation becomes evident, or if the patient is suddenly attacked by spasm of the larynx, threatening immediate death. Even if the benefit from laryngotomy be not effectual, it affords much immediate relief to the distress of the symptoms, and certainly prolongs life in most cases. W. S., æt. 45, was admitted on the 29th September 1845 into St. George's Hospital, with difficulty of breathing and swallowing, and all the symptoms of diffuse cellular inflammation, extending down the pharynx and œsophagus. On the 2d October, at five a.m., he was attacked with a paroxysm of dyspnœa, and became quite black in the face and insensible. Laryngotomy was at once performed; and after artificial respiration had been kept up some time, consciousness returned*; but it was found that the patient was utterly unable to swallow any thing, and he died the following day. The effusion of lymph extended from the cellular tissue round the glottis, downwards around the œsophagus, in the anterior as well as the posterior mediastinum, as low as the diaphragm.* It will be evident to the

* Post-mortem and Case Book, 1845, no. 234.

reader, with the above case before him, that when the mischief extends beyond and below the pharynx, and the infiltration is of a purulent character, no possible advantage can be derived from any form of treatment. The patient dies, either in a paroxysm of dyspnœa, or poisoned by the pus locked up in the cellular tissue of the thorax.

Abscess of the pharynx is an occasional occurrence; is generally a formidable evil; and is often, as a cause or result, connected with some disease of the cervical vertebræ. Much care must be taken to arrive at a correct diagnosis of such a case; for it may readily be mistaken for a polypoid or other solid growth of the walls or cavity of the pharynx.

The following case will illustrate the importance of this precaution:—An abscess, the size of a pigeon's egg, was situated between the bodies of the upper cervical vertebræ and the back of the pharynx, but from being flattened in front did not cause any material projection of the posterior wall of the pharynx. In connexion with the abscess, a second small cyst was prolonged forwards, so as to form a nipple-like swelling in the pharynx; and this compressed and completely closed the orifice of the glottis. The aperture of communication between this process and the body of the abscess admitted the point of the little finger; and the whole swelling was freely movable and perfectly translucent at its extremities and sides. This abscess occurred in an infant seven months old, who had suffered from dyspnœa for three weeks. The difficulty of breathing became very urgent three days before death; was constant, though less urgent at intervals; but the slightest exposure to cold, any motion or excitement, brought on a recurrence of threatened suffocation, attended by a peculiar croupy inspiratory sound. There was no attendant difficulty of swallowing, and no other disease was found after death.* Abscess may arise from an injury to the pharyngeal mucous membrane, caused by the passage or the impaction of a foreign body. In the Museum of St. George's Hospital is a preparation which shows an irregular ulcer, communicating with an abscess, on the posterior wall of the pharynx, which was removed from the body of a young woman who died from its effects, and who had, some six weeks previous to her death, swallowed some pins, one of which was supposed to have lodged in the pharynx, and produced the mischief which so shortly terminated in death.

Ulceration of the mucous membrane of the pharynx is usually the consequence of syphilis; more rarely it is the result of scrofulous influence. In children, the latter condition is sometimes observed to produce considerable destruction of the soft tissues, and its progress is very difficult to control. The symptoms generally are, offensive breath; offensive purulent secretion from the nostrils, and excoriated nasal apertures; constant cough; and the external characteristics of a strumous diathesis. The ulceration is readily seen when the mouth is opened; is not deep, but irregular, and the edges of the ulcer usually well defined; with crusts of dried secretion, often highly offensive, sticking in patches to its surface. There is not much pain complained of; perhaps some, less or more, is experienced when food is taken.

* *Transactions of Path. Society*, vol. i. p. 61.

This characteristic form of ulceration is extremely obstinate in duration, and often extends to the tissues of the soft and hard palate, as well as to the nares. In the case of a little girl in St. George's Hospital, the mischief spread most unrelentingly from the pharynx to the nose and mouth, and from the mucous surface to the deeper tissues; until the nose fell in, and the greater portion of the palate, soft and hard, was destroyed, leaving the child a dreadfully disfigured object.

This strumous form of ulceration is certainly found to exist in children more frequently than in adults. The treatment is to be directed chiefly to constitutional measures, though local applications may also prove beneficial. It should consist of the various tonics, which are beneficial in the management of scrofulous cases generally, aided by good living, great attention to cleanliness and pure air, and, if within the means of the patient, a sea-side residence; the Isle of Thanet is especially to be recommended.

Syphilitic ulceration of the pharynx is very commonly observed, especially in the lower classes of the metropolis. It is constantly seen to attack the posterior wall of the pharynx; but is usually accompanied by ulceration of the velum or tonsils, or some other secondary evidence of the prevailing poison.

Its character may be suspected by the age of the patient, the period of its duration, and other symptoms which may be present; *i.e.* rupial sores in the skin; nodes of the skull or other bones; pains in the limbs or joints; general reduction of health and flesh; and last, not least, the confession (not always to be obtained) of a former primary sore, with perhaps a mark of its recent habitation.

Such an ulceration will usually yield rapidly and satisfactorily to treatment. It granulates, contracts, and cicatrises under the influence of iodide of iron, or iodide of potassium alone; and if thus treated in its earlier conditions, leaves behind but little to mark locally its former existence.

It happens, however, in some instances, whether from neglect, or from misapplied treatment, or from a state of deteriorated constitution, that there arises a greater virulence in this ulcerative action; and that the ulceration spreads not only to the sides and posterior wall of the pharynx, but also implicates the velum and arches of the palate, leaving a very extensive surface entirely denuded of mucous membrane. Under such circumstances, the patient will be found in a deplorable state; he has great difficulty in swallowing, and he becomes greatly reduced from inability to take sufficient nourishment. When, under judicious treatment, cicatrisation commences, it will generally be found that as the ulcerated surface contracts, the soft palate becomes displaced, and adherent by its margins to some portion, or occasionally to the entire surrounding surface, of the pharyngeal wall. As a result, the soft palate has been occasionally seen adherent to and continuous with the wall of the pharynx, so that all communication between the oeso-

phagus and the nares was entirely cut off. An operation may, perhaps, partly relieve this evil; but if undertaken, there is usually much difficulty in again preventing adhesions of the parts during cicatrisation. Very little benefit has attended attempts to remedy defects dependent on adhesions of the soft palate the result of ulceration.

Dilatation of the pharynx may occur in two forms; it may be dilated throughout, or only partially. The latter condition is met with occasionally; the former very rarely. The symptoms noticed in cases where a pouch has been found after death, are difficulty in swallowing much food, and vomiting of food, which has been felt to stick in the throat. In one case,* the patient (who died at the age of 90) was accustomed to press on the pouch and force the food into the œsophagus.

Tumours attached to the pharynx are not very commonly observed. When they occur, they are generally apt to be somewhat pendulous, and are often attached to a portion of the walls by a narrow neck. They have been found to consist of fat, fibrous or fibro-cellular tissue. But the character of the growth is perhaps of less importance as regards the immediate treatment, than the shape, the size, the position, and the attachment of the mass.

The record, with a coloured illustration, of a fatty tumour of the pharynx, is to be found in the *Transactions of the Pathological Society*, vol. v. p. 123, by Mr. Holt. This specimen was removed from the body of a man eighty years of age. Twelve years previously, his attention had been first drawn to his throat, from an occasional sensation of choking. About four years previous to his death, during an attack of vomiting, a large mass was protruded into the mouth; and, to prevent immediate suffocation, he was compelled to return it as quickly as possible. He was at all times better able to swallow fluids than solids. He died suddenly while in the act of smoking.

The tumour was found to be a large, pendulous, fatty mass, filling the pharynx and extending downwards to the œsophagus for nine inches. It was attached by fibrous tissue, covered by mucous membrane, to the left side of the epiglottis, and also to the upper part and side of the pharynx. The tumour had by its weight so dragged upon the epiglottis, that the perfect closure of the laryngeal aperture was not practicable. The mass, except at its attachments, was hanging loose in the pharynx and œsophagus. It consisted of adipose tissue.

In the College of Surgeons are two specimens of tumours of the pharynx, successfully removed during life. One† is a large, soft, lobulated mass, apparently fatty or gelatinous, like a nasal polypus. It was attached by a narrow pedicle behind the tonsil. A second‡ is apparently a firm, fibrous mass, and was attached by a narrow pedicle to the wall of the pharynx.

Other cases have been observed in which tumours, either of a fatty or fibrous structure, have encroached on the cavity of the pharynx, without becoming pendulous; they have been seen to grow and insinuate themselves under the mucous membrane; and as they increased in size, so they interfered with the aperture of the glottis, and interrupted the passage of food to the stomach.

* Museum of Royal College of Surgeons, no. 1886.

† Ibid. no. 1090.

‡ Ibid. no. 1091.

The treatment of tumours located in and attached to the walls of the pharynx is often attended by much anxiety, as their removal is an operation of much hazard. But that their removal should be had recourse to, and that that removal should be undertaken at as early a stage as possible, we need not attempt to impress upon the reader.

The only hope of benefit must be from treatment restricted to the pendulous form of tumour. The attempt to remove a tumour attached throughout to the walls of the pharynx would be a highly hazardous proceeding, and most probably unsuccessful in its results, if not fatal during its progress. When the tumour is pendulous, no time should be lost before the endeavour be made to remove it. If not large, and attached to the upper part or side of the pharynx, it may be seized with a vulsellum, and the pedicle cut through with a knife. If the mass appears very vascular, or large vessels are detected running through the pedicle, a double ligature may be first passed through the base, and when securely tied the mass may be with safety cut off beyond it. A ligature through the pedicle is far preferable to one round it; for when the mass beyond is removed by the knife, the latter is apt to slip off, and possibly some hæmorrhage might ensue.

The chief, and probably the only risk the Surgeon has to fear in an attempt to remove a polypoid mass from the pharynx, is that of suffocation, produced either by the mass itself filling up the fauces and pressing down the epiglottis, or by spasm of the glottis, the result of irritation from the tumour coming in contact with the surface of the laryngeal mucous membrane. If the character of the tumour recorded in the *Transactions of the Pathological Society* by Mr. Holt be considered—its attachments, its size, and the extreme feasibility of its removal, either in great part or in its entirety, *supposing* there was no risk of suffocation; if it be remembered that the tumour could not have been drawn into the mouth without the aperture of the glottis being stopped up, but that otherwise the mass might easily have been drawn forwards, and the greater portion removed,—would it not be justifiable, we ask, under all such circumstances, that, prior to an attempt being made to remove such a tumour, the precaution should be taken to perform laryngotomy, and to introduce the tube into the larynx as a safety-valve for the patient to breathe through while the operation was in progress? We should have no hesitation to perform this operation under circumstances such as were attendant upon the case related, and prior to a proposed removal of a tumour; nor have we any hesitation in strongly recommending the adoption of such a precaution under similar conditions. The operation of laryngotomy is simple; it is so safe in its results, provided the parts are in a healthy condition, that no danger or irritation need be apprehended from the introduction of the tube. The author operated himself, and witnessed several other instances in which the operation had been performed on patients under the care of the late Dr. Marshall Hall, for the relief of epilepsy; and in no case was there the least approach to danger from the operation itself, or from the presence of the tube in the larynx. Under circumstances similar to those related by Mr. Holt, laryngotomy would insure the safety of the patient's life, during an attempt made to remove a pendulous mass from the pharynx through the mouth; and the tube might be retained, until reparation took place in the wound occasioned by the removal of the tumour.

Diseases of the Œsophagus.

Congenital malformation of the œsophagus is rare. It usually proves fatal within a few days of birth.

Dilatation of the œsophagus, and pouches connected with that

tube, are morbid conditions of occasional occurrence. Cases of the former have been put on record by Rokitansky* and by Dr. Barker.†

Contraction of the œsophagus is a very common evil. It is usually an insurmountable difficulty to the Surgeon, and in the majority of cases rapidly reduces and destroys its victim.

Contraction, or “stricture” of the œsophagus, may be the result of several distinct conditions. Folds of the mucous membrane; cicatrices after injury; pressure occasioned by neighbouring tumours; thickening and contraction of the walls; or, lastly, and most frequently, cancerous affections of the tube,—are the chief causes of stricture of the œsophagus.

In the Museum of the College of Surgeons is a specimen (no. 1079) which shows stricture of the œsophagus from a fold of mucous membrane. Just below the cricoid cartilage, the œsophagus gradually contracts to half its diameter, and then dilates. The mucous membrane at the contracted part forms transverse sharp-edged and projecting folds, which pass round the chief part of the circumference of the tube. The surrounding tissues are also condensed, as if the result of cicatrix. There is no history to the specimen. Another preparation (no. 1080) shows a very similar condition in the œsophagus of a child, probably the result of some acrid substance having been swallowed. A preparation removed from the body of a boy ten years of age shows a contracted state of the œsophagus, subsequent to the action of sulphuric acid swallowed during life. With respect to the changes subsequent to the passage of an acrid poison over the mucous surface of the œsophagus, Rokitansky remarks, that when “the mucous membrane has been destroyed by the energetic action of the poison, it is replaced by a serous and sero-fibrous tissue, which gives rise to peculiar valvular strictures of the œsophagus, somewhat analogous to those consequent on dysentery.”‡

In the Museum of St. George's Hospital is a preparation of a portion of an œsophagus, in which may be seen a constriction about three inches from its upper extremity—the result of a piece of bone becoming impacted for a time in the passage, and having set up inflammation around the part. This mischief extended to the præ-vertebral areolar tissue of the cervical region, followed by ulceration of the inter-vertebral cartilage of the third and fourth cervical. The ulceration went on to perforation of the spinal canal, and produced inflammation of the membranes and softening of the spinal cord. The piece of bone, of considerable size, had stuck in the throat for a time, but was subsequently removed. Large quantities of pus were afterwards spat up.§

Simple stricture of the œsophagus, from thickening and contraction of its walls, is occasionally met with, and apparently without satisfactory explanation. Mr. Liston exhibited at the Pathological Society a specimen possessing some interesting features. The stricture existed at the upper part of the tube, was about an inch in length, and only capable of allowing the passage of a goose-quill. The contraction had existed for a number of years; there was considerable hypertrophy of the constrictors of the pharynx, especially of the superior one. The upper horns of the thyroid cartilage were so approximated as to leave but a space of $\frac{1}{8}$ ths of an inch, being a diminution of about an inch in the breadth of the natural interval between them. The

* *Path. Anat.* vol. ii. p. 8.

† *Path. Anat.* vol. ii. p. 10.

‡ *Path. Soc. Trans.* x. 140.

§ *Post-mortem Book*, 1852, fol. 36.

patient had been under the care of Cruikshank and John Hunter, and lived to between seventy and eighty.

It is unnecessary to multiply instances of these forms of contraction ; there are, however, certain circumstances in connexion with their progress, which will form the subject of consideration when their diagnosis and treatment are discussed.

Complete obstruction to the passage of food from the pressure of a tumour on the œsophagus is very rare. Occasionally some degree of difficulty in swallowing is experienced, from the presence of a tumour of a cancerous nature ; or from the thyroid, when very large, or when it wraps round the trachea ; or from an aneurism or any other kind of swelling in the neck.

Evidence of supposed pressure from a tumour must, however, be carefully weighed, before a decision be arrived at respecting its influence in this respect. Dr. Wilks* has very properly drawn attention to the circumstance, that obstruction was attributed to an exostosis of the vertebræ, when actual disease of the œsophagus and stricture existed above the seat of the exostosis.

The most frequent causes of obstruction to the passage of food, attended by rapid deterioration, and followed by early death, are cancerous affections of the œsophagus. They occur in various forms. The epithelial variety of ulceration with contraction is most common, but medullary, villous, or colloid cancer occur somewhat in proportion to the order in which we have placed them.

Cancerous ulceration or stricture of the œsophagus is a disease of age. We are not aware of its occurrence in youth or early life. Rokitsansky states that "cancer of the œsophagus generally occurs in an isolated form, *i.e.* without the co existence of the disease in other organs."† Such is no doubt often the case, but the rule is made too general to be correct ; the reader may satisfy himself that we differ with the great pathologist on reasonable grounds, by reference to the *Transactions of the Pathological Society*.

The usual symptoms of stricture are, first, a slight difficulty in the passage of solid food to the stomach. The difficulty gradually increases ; sooner or later the patient is compelled to restrict himself entirely to food of a fluid form. By degrees he finds that this he can take only in gradually reduced quantities, until at last he sips but a few drops at a time ; or even this small quantity may be rejected, shortly after an attempt made to swallow it.

A patient with stricture of the œsophagus rapidly emaciates : he visibly deteriorates in physical power and in substance from day to day ; the circulation becomes feeble, he complains of a sensation of cold on temperate days, and he becomes very susceptible to all changes of the atmosphere.

If there be ulceration in the upper part of the œsophagus, or the pharynx be also implicated, there is generally a disagreeable smell in the patient's breath, easily detected by a visitor on entering the room. The patient is often subject to expectoration, and the secretion spat up is semi-purulent, and occasionally very offensive. He complains of intense hunger in the earlier period of the disease, and when solid food can no longer be taken ; but gradually he

* *Pathological Transactions*, vol. xii. p. 101.

† *Pathological Anatomy*, vol. ii. p. 12.

succumbs to the privation, and latterly is often indifferent respecting it.

When once the patient is restricted to fluid nourishment alone, the quantity taken is by no means sufficient to sustain life; so that the medical attendant may predict the approaching end as not far distant, when perhaps the patient or his surrounding friends may be little prepared for such an announcement.

Occasional complications occur in the progress of stricture of the œsophagus to which our attention is requisite; they render the disease more distressing to the patient, but generally hasten the termination of his sufferings. The epithelial variety of ulceration is apt to spread superficially without destroying the tissues deeply; and though a large surface may be implicated, the patient so affected will survive longer than one affected by the medullary form of cancer. With the latter form of disease the surrounding tissues become implicated at an early period, and thus the passage may become much constricted soon after the stricture is suspected. Ulceration of the tube above or about the diseased mass will generally take place, and cavities in the cellular tissue around will be constantly found communicating with the ulcerated points of the œsophagus. Occasionally the destruction makes its way outwards, until several openings are formed externally about the neck, and allow the escape, not only of matter, but also of the fluids taken as nourishment. Or the ulcerative action may run in a different direction, burrow about the muscles of the neck, or effect a fistulous communication with the trachea. The latter condition is made evident by fluids, taken through the mouth, being coughed up through the glottis.

In other instances, almost instantaneous death will occur from sudden and violent hæmorrhage, dependent on the ulceration of a large artery.*

The symptoms of stricture of the œsophagus are so marked, that it might at first sight appear almost impossible to be deceived regarding its occurrence. But an hysterical spasmodic condition of the pharynx or œsophagus is occasionally met with, and might be mistaken for organic mischief, without some precaution and judgment brought to bear on the case. It is therefore prudent to weigh

* A case is recorded in the *Transactions of the Pathological Society* (vol. ix. p. 194) of death by hæmorrhage from ulceration extending from the œsophagus to the right subclavian. And a second instance (*ibid.* p. 202), in which death was the result of perforation of the superior intercostal, by extension of the ulceration from the cancerous stricture. The vertebral artery has been known to be perforated under similar conditions.

carefully the symptoms of all cases of supposed stricture of the œsophagus, in order to be able to discriminate between actual stricture, and that of nervous origin. The latter disorder is not very commonly met with; but it will be found, as a rule, to occur in women. In two instances familiar to us, the symptoms were evidently entirely due to the state of health, and yielded effectually to constitutional treatment. The symptom which commonly distinguishes an hysterical or spasmodic difficulty in swallowing from a real stricture, is the easy manner in which a patient can swallow fluids, or even solids, when allowed to take them apparently unobserved. There is little, if any, emaciation; nor is there the early indication of loss of strength; nor the constant desire for food if it could only be swallowed.

The diagnosis of stricture of the œsophagus is generally very easy and sure. It comes on after mid-life. The patient experiences a constant craving for food, but an inability to partake of it. He longs for it, and would at any moment partake of a large meal, if it could possibly pass to the stomach. "You know nothing of the pangs of hunger," observed an eminent member of our profession, when dying of cancerous stricture of the œsophagus. "Day and night I suffer horrible tortures from absence of food from the stomach; but I can swallow nothing."

When a pouch of the pharynx or œsophagus exists, it may be suspected, if, after partaking of food, the patient feels any fulness in the neck, or if, after a time, a portion of the meal is returned. As the pouch is capable of holding a certain quantity, there is not so much difficulty in disposing of a portion of solid food as in stricture; for a part may pass into the œsophagus, and the rest into the pouch. A patient suffering from a pouchy condition of the tube does not emaciate so rapidly as one affected by stricture; several instances on record having lived to good old age.

The treatment of stricture of the œsophagus is summed up in a very few words.

If hysterical, general constitutional treatment will overcome it, without much difficulty, in a comparatively short time.

If permanent, from cicatrix or other disease, we can offer very little hope of benefit from treatment. When the result of cicatrix, or supposed folds of mucous membrane, the application of caustic has been recommended and tried. The use of bougies has perhaps been followed by some partial relief. But all treatment is, at the best, unsatisfactory. When cancerous, the treatment most suited to relieve suffering, and to soothe the distress of the patient's closing days, is the administration of enemata of strong beef-tea and laudanum; and at the same time the allowance of whatever fluid he relishes, either to wash out the mouth, or to swallow. The enemata may be repeated with great benefit every four or six hours, according to the feelings or wishes of the patient. Such treatment will prolong life some days; and it may be a

matter of very considerable importance to the surviving members of a family, that a life should be prolonged over a certain period, not far distant, when the medical attendant is first consulted.

We cannot recommend the use of bougies in the treatment of stricture of the œsophagus. In its early stage, curiosity may perhaps require to be satisfied by an exploration, so that the exact seat of the stricture be ascertained; and to such a proceeding there is no great objection. But, beyond this, very little, if any thing, is gained by such treatment. In attempts made to pass a bougie through the stricture, the end of the instrument has been known to find its way into the mediastinum; into the cavity of the pleura; and into the cavity of the pericardium. In each instance the instrument was used by skilful hands; but, in all the cases, rapid death supervened upon the severe symptoms which followed the withdrawal of the bougie.

It is wise in such cases to refrain from interference without some certain prospect of good; for in these cases, as in all, meddlesome surgery is bad.

ABDOMINAL ABSCESES.

Abscess originating in the substance of the anterior abdominal wall, or in the sub-peritoneal cellular tissue, in the region of the loins, or pelvis, and totally unconnected with disease of bone, is not a very common occurrence; but as we occasionally meet with one, it is requisite to allude to its peculiarities and treatment.

An abscess confined to the substance of the muscular parietes is most frequently the result of a bruise, and may be treated as abscess in any other position. But one commencing in the cellular tissue of the loin, or iliac region, is generally obscure in the commencement; frequently produces much constitutional disturbance in its progress; and is very often fatal in its results. Abscesses occurring in these situations are sometimes slow in formation; but in other instances form with great rapidity, and acquire a large size within two or three weeks. According to the rapidity of their progress will be the acuteness of the symptoms which accompany them. They are as frequently seen in children as in adults. Without careful examination, they may be readily mistaken for psoas abscess dependent on diseased vertebræ, or for some kind of tumour growing in the cavity of the abdomen. In children, from the resistance of the abdominal and psoas muscles, and the drawing up of the thigh on the belly, disease of the hip-joint might be suspected, if the conditions be not particularly examined into.

A very sickly child was admitted into the Hospital for Sick Children, under the care of Dr. Jenner, with a large prominent roundish swelling on the left side, between the region of the kidney and Poupart's ligament. There was very little indication of pus, or fluid, in the swelling; its shape and consistence conveyed the impression that it might be a malignant growth. As some doubt existed as to its character, a fine trochar was passed into it by the writer, and some thick pus immediately escaped through the canula. A small opening was then made through the parietes into the abscess, and allowed the free escape of pus. The child very shortly recovered.—A child was admitted into St. George's Hospital with much swelling, and great ten-

derness about the left iliac fossa; the thigh was bent on the body, and kept drawn up; any attempt to extend it was attended by great pain; so much so, that it was impossible, on account of the struggling and crying of the child, to make out the extent or the seat of the mischief. Chloroform was therefore administered; under its influence the thigh was readily extended, and the mischief found to be confined to the iliac fossa. Here was a swelling of some extent, and all the tissues over it thickened and hardened; the skin was darker coloured and more red than natural. Though fluctuation could not be detected, a small incision was made over the most prominent point, and cautiously extended to some depth; but as no pus escaped, exploration was not carried farther, and a poultice was ordered to be applied. On the second day, a sudden flow of pus took place through the wound; relief to all the urgent symptoms followed; and the child recovered shortly.

Acute and large abscesses occur in the sub-peritoneal cellular tissue about the region of the ovaries after the period of childbirth. For an account of them, and their treatment, we must refer the reader to Vol. i. p. 153.

Abscess of the abdominal region is often connected with an artificial aperture in the alimentary canal, either stomach or intestine. Such an abscess may arise from perforation of the bowel, the result of simple ulceration; or the lodgment of any foreign body in the intestine; often from ulceration, set up in the gall-bladder by a gall-stone; or from stricture of the intestine; and most frequently from some cancerous disease of the alimentary tube.

When such an abscess occurs, its contents will generally consist of pus and fæces mixed together; but occasionally the opening in the bowel has been so small, that very little of its contents have escaped; sufficient, however, to set up the secondary mischief. When such an abscess is opened, the escape of mere pus alone does not justify an opinion that the bowel neither is, nor has been, implicated. It will happen occasionally, some days after clear pus has been discharged from the opening, that fæculent matter is observed for the first time to be coming away with the discharge. As the walls of the abscess contract, they probably have disturbed the former attachments of the intestine, and thus facilitated the renewal of an escape of its contents.

Abscesses connected with the bowel cannot be said to follow any definite rule, either as to symptoms, rate of progress, or termination. They may be obscure in their commencement, or marked by violent pain, and in their progress; while the medical attendant may be daily watching for an opportunity to give exit to pus at some favourable point, the swelling may suddenly subside, and disappear by evacuating the contents, through some fresh opening, into the bowel, the pus being discharged per anum.

When of an acute character, the symptoms of a "fæcal abscess" are very marked. Sudden pain is referred to the part affected, often of a very severe character; constipation often anticipates the

attack, or accompanies it. The pulse and tongue sympathise early in the mischief; the former becomes rapid; the latter loaded and creamy, and soon dry and brown. There is often great anxiety and restlessness; much thirst, and a hot dry skin. There is very frequently, early in the attack, distinct fulness of the part implicated; and, in addition to extreme tenderness and an intolerance of pressure, general indications of diffused peritoneal inflammation. The most frequent seat of such abscesses is the region of the ilio-cæcal valve—the right iliac fossa; but they may occur in any part of the abdomen.

Sometimes the formation of pus is so rapid, and the mischief in the peritoneal cavity so general, that the patient dies within a few days of the first symptom of pain. Mr. —, late House-Surgeon of St. George's Hospital, while walking in Hyde Park, was suddenly seized with excruciating pain about the right iliac fossa. Though but a very short distance from his lodgings, he was obliged to be carried home. When seen by the author in the evening, there was intense pain in the right iliac region, with a certain amount of fulness, and great tenderness on pressure. The skin was hot; the pulse rapid; and there was great anxiety of countenance. The symptoms were in no way relieved by the treatment prescribed in consultation with the late Dr. Bright. The case proved fatal in a few days. On examination after death, a large abscess was found to occupy the right iliac fossa; the boundaries were formed by adhesions of the intestines and the parietal peritoneum. The contents were pus and fæces. The appendix cæci was found ulcerated through at its extremity. No solid substance could be found, to account for the ulceration from pressure or other cause.

Occasionally an abscess in this neighbourhood is much more tardy in its progress; and although matter continues to collect, the patient, having passed over the first acute stage of the attack, may soon improve in health and appetite; the general tenderness of the abdomen, or distension of the bowels,—should either have existed,—commence to subside; and a local swelling remains in some portion of the abdomen, marked by external fulness, and often by a well-defined surrounding wall. The skin over this part becomes more red and shining than that of the immediate neighbouring surface; then darkens in colour, and becomes thinner at one or more spots; and either ulcerates or is punctured, when pus readily escapes.

It is a safe and a very judicious proceeding to open such an abscess, as soon as it may be suspected to have formed, and within reach of the knife. If the incision be delayed until matter makes its approach towards the surface, it will generally happen, during this process towards self-liberation, that the pus works its way in several directions; it has been so long kept back by the resisting action of the abdominal muscles and fasciæ, that it has burrowed wide and deep: so when the external opening has been long postponed, by nature or the Surgeon, we find, in addition to the suppurating cavity in the iliac region, that the abscess has passed under Poupart's ligament and among the adductor muscles of the thigh, or deep into the pelvis, and may present itself in the perineum, or has even opened into the rectum or vagina. We can never define what bed these abscesses may form for themselves, or how,

when, or where they will discharge their contents. If one be opened late in the progress of the case, long sinuses will often be found leading from the opening in the abdominal wall to the surrounding parts, and thus render the ready escape of matter difficult. Under such circumstances, after a time, other collections of matter point, either in the groin, in the thigh, or about the ischiatic rami. Many a patient will, however, sink soon after the opening of a fæcal abscess: not only has he to contend against the effects of profuse discharge, but he has also the extra evil of a too ready and early escape of intestinal contents from the opening in the bowel.

Notwithstanding the severity of such cases in their general aspect, and the frequently fatal results they entail, we occasionally find a patient gradually recover, as it were from a bed of death, and after he has endured the opening of a great number of consecutive abscesses; the sinuses slowly contract; the discharge diminishes by degrees, and ultimately ceases; and the orifices of the abscesses cicatrise one by one. The patient, however, recovers with a crippled limb, as a general rule. The suppurative action usually implicates the psoas and iliacus so much, and often the adductor muscles, that the movements of the thigh are subsequently restricted, nor can the limb be extended to its natural limit.

The general treatment of this class of cases is not to be laid down as simple, nor conveyed in a few words. It depends entirely on the course of the case.

In the early stage, *i. e.* of pain, constipation, and fever, constitutional measures and local treatment must be combined. Opium internally, and hot fomentations, perhaps leeches, externally, are usually most beneficial at first. Opium may be given in full doses, and often repeated. It may be requisite to combine small doses of calomel with it. Purgatives, as a rule, should be strictly avoided. Under the influence of opium alone, or combined with calomel, the bowels will act as early as their condition will permit; and quite soon enough to answer nature's purpose, *if they will act at all*, without the aid of purgatives.

When the patient survives the shock of the attack of inflammation, so soon as matter is suspected, the part should be explored, and, if possible, the pus let free. Under the influence of chloroform alone, can a satisfactory examination be made, in a case such as we are now considering; and we would, under all conditions which indicate, though they do not absolutely prove, the presence of pus, urge the use of chloroform, that a thorough examination may be instituted, and exploration made if deemed advisable.

Great attention and care in treatment is necessary, as soon as the pus has an outlet. Strict cleanliness is requisite, to prevent excoriation from the discharge, and also to avoid bed-sores. As the discharge is often extremely offensive, the chamber becomes insufferable, if not constantly and carefully ventilated. A free use of disinfectants is requisite in the room, as well as in the local dressings. A constant and liberal supply of nutritious food and stimulants are wanted to meet the wasting and lowering effects of profuse secretion from the abscess. It is often surprising to observe the quantity of wine patients require, and will take with impunity, under these conditions. The bowels must be carefully watched; they are often apt to become relaxed, and this diarrhœa, if unchecked, tends to reduce the patient. If collections of matter should point in other parts, they ought at once to be let out; or if superficial sinuses lead from one abscess to another, they should be slit up.

The usual conditions found after death, in cases of fæcal abscess, are general adhesions of the intestines and viscera in the immediate neighbourhood; some portions of which may form the boundaries of the abscess-wall. The communication with the intestine is generally very clear; often several may be observed; but when more than one exists, the others are commonly the result of ulceration *from* the abscess *into* the gut.

Most commonly the mischief which produces fæcal abscess, independent of cancer, arises near the ilio-cæcal valve: ulceration of the appendix is one of the most frequent causes. In the *Transactions of the Pathological Society*

(vol. vii. p. 210) is recorded a case, in which perforation of the cæcal appendix was occasioned by the impaction in it of an intestinal concretion. Another case is detailed (vol. xii. p. 85), in which a fistulous orifice in the abdominal parietes opened into a circumscribed cavity, which communicated with the interior of the colon and duodenum, and indirectly with the gall-bladder. This was probably the result of a gall-stone ulcerating into the duodenum, and accidental rupture of the colon.

Fæcal abscesses and fæcal fistulæ occur in other parts of the abdominal wall; they are most frequently connected with the large intestine, and are generally the result of some cancerous obstruction, attended by ulceration of the bowel above, which, extending to the integuments, allows a partial escape of feces. A case of fæcal abscess and fistulæ communicating with the cæcum, caused by cancerous disease of the large intestine, is recorded in the *Transactions of the Pathological Society*, vol. i. p. 265; another, of abscess in the abdominal walls in connexion with cancer of the stomach, vol. xi. p. 122; and a third, of fistulous openings through the abdominal parietes communicating with the transverse colon and stomach, the result of cancerous disease, vol. viii. p. 221.

The treatment of such cases dependent on cancer does not call for much remark. They often linger much longer than might be expected, provided the patient can take plenty of nourishment; but they often succumb much more rapidly than anticipated by those in attendance: it is therefore best to warn the relatives of the sufferer of the possibility of sudden collapse in such a disease.

INTESTINAL OBSTRUCTIONS.

The causes of intestinal obstruction are so various; its occurrence is fraught with so much danger; its symptoms are so severe and distressing; its diagnosis is so obscure; and its treatment so uncertain, and so often unsuccessful,—that it is with the greatest diffidence we undertake the consideration of such an important subject, as the pathology and the symptoms of intestinal obstructions, and the measures to be employed for their relief.

In entering upon an inquiry beset with so many difficulties, it has appeared to us a very important point, at the outset, to endeavour to classify the causes of obstruction, so that, in some measure, we may be able to determine, according to the symptoms, whether the obstruction depends on an acute strangulation, entailing great and imminent danger to life; or on a slowly altered condition of the intestine itself, or of the adjacent tissues. Under the first condition the treatment must be decided; and to prove effective, must be early applied. In the second, there is generally more time to consider the prospects of life, and the advantages of interference. In the first, without prompt and entire relief, death generally follows rapidly in the wake of the onset of the symptoms. In the second, while we are calculating our measures, the symptoms may even subside; and their sudden cessation be followed by perfect recovery.

We therefore propose to divide the causes of obstruction into, 1st, those we may term sudden; such as are productive of acute and rapidly fatal results, if not presently relieved: and 2d, those more slowly acting; productive of symptoms, chronic when compared with the first; and such as sometimes subside with the aid of medicine alone, or even occasionally without it. Those which generally produce most acute symptoms, early in their attack, sudden in their nature, and rapidly fatal in their results, comprise,

1. Congenital strictures, or malformations.
2. Foreign bodies impacted in the intestines, and introduced through the stomach; formed in the gut; or escaping, by ulceration, from the gall-bladder.
3. Twisting, or "dislocation," of the bowel—most frequently observed in the large, but often in the small, intestine.
4. Loops, formed by bands of false membrane, adherent at both extremities; by diverticula, adherent by their apices to some portion of the viscera or abdominal wall; or by the fimbriated processes, or other portions of viscera, contracting adhesions, so as to form rings, or apertures, for intestine to become entangled in—all these usually the result of peritoneal inflammation.
5. Mesenteric pouches; foramen of Winslow; or "thickened peritoneal sheaths,"* the result of old herniæ.
6. Invagination—often caused by worms, intestinal polypi, &c.

It is hardly necessary to mention, that all forms of external hernia are excluded in this consideration.

The more slowly acting processes productive of obstruction, in which the symptoms are at first not urgent, and in which recovery sometimes will occur without assistance from treatment, and often when all hope of life may have vanished, are—

1. Constipation, habitual or accidental.
2. Inflamed, thickened intestine, the result of injury.
3. Chronic peritonitis (tubercular) and abscess.
4. Tumours pressing on the bowel—hydatids, &c.
5. Simple stricture of intestine, the result of ulceration and other causes.
6. Cancer of the bowel, producing contraction of the gut.

Although we have divided these usual causes of obstruction into two classes, each productive of its peculiar train of symptoms and effects, one of the acute character, the other of a chronic nature,

* Rokitsky's *Pathological Anatomy*, vol. ii. p. 59.

yet it must be clearly understood, for it will certainly be found so in practice, that this division must only be taken as a mere outline map of the difficult country we have to explore; that in many cases the symptoms may subside from the acute into the chronic, or from a quiet state become very severe. It must not be taken as a fact in every case, that acute symptoms cannot, or do not, depend on any one of the latter causes of obstruction; or a more chronic state of symptoms on any of the conditions noted in the first division; but as a general rule, we may venture with some degree of assurance to assert, that the several symptoms which will mark the cases coming under our first division are urgent, acute, and rapidly result in collapse and death, if not relieved by nature or art; while the greater number comprised in the second division are attended by symptoms which come on by degrees, may last many days, often weeks, or even months in some cases; are generally by so much the less urgent than the former in character, and permit of delay in treatment as regards surgical interference; allow time for consultation; are often capable of medical relief; and, if surgical treatment be considered requisite, offer many more features favourable towards the prolongation of life, than do the acute cases of obstruction. It must be borne in mind, that constipation, or entire stoppage of defæcation, is not an absolutely requisite symptom to indicate fatal obstruction of the intestine; nor, in suspected organic obstruction, should we presume to say that the disease has yielded to our treatment, even though diarrhœal action of the bowels comes on; it will probably last but for a short time, or the quantity of fluid passed will be small in proportion to the frequency of the motions. A relaxed state of the bowels in stricture is usually indicative of ulceration, and may occur, in old contracted stricture of the intestine, within a very short period of death. Cases illustrative of these various symptoms will be introduced as we proceed.

1. Congenital malformations of the intestinal canal, giving rise to immediate obstruction, are almost entirely confined to the rectum and its external aperture. These deformities, and their treatment, will be found described in the essay on THE SURGERY OF CHILDHOOD, and therefore require no further notice here.

Another, but very rare condition of stricture, has been occasionally found in the duodenum of infants; the two following cases illustrate these structural alterations.

A child, when born, presented no unusual symptoms for the first twenty-four hours; vomiting then came on, and continued, with short intermissions, until death, which took place some thirty-eight hours after birth. The bowels were never relieved during life. The only disease found was a stricture of the

duodenum, close to the entrance of the gall-duct; so that a probe passed down the latter entered the duodenum immediately below the constriction. There was nothing to indicate in what manner the constriction had occurred. On the gastric side of the latter, the duodenum was immensely distended; so much so, that at first sight it appeared like the pyloric end of the stomach itself; and only by a more careful examination was the distinction between the stomach and intestine detected, by a ridge running around their junction point.*

A child eighteen months old was admitted into the Hospital for Sick Children, under Dr. West, apparently in much pain; constantly whining, restless, and throwing about her legs and arms. The mother had noticed that the child vomited frequently, rejecting every thing she took; there was considerable constipation. The child died in a few days.

The stomach presented a constriction, beyond which was a pouch which looked at first like the stomach, but ended sharply at a spot where there was a fold of mucous membrane; beyond this followed intestine of ordinary character. A probe inserted into the bile-duct, from without, passed between the two surfaces of this septum, and appeared just below the stricture. The pouch was detected to be duodenum; and what appeared to be a fold of mucous membrane at the further end of the pouch, proved to be a septum stretched, with a slight obliquity, across the calibre of the bowel. The septum was perforated almost exactly in the middle, by a small hole nearly circular, and with a smooth edge. The valve possessed all the ordinary characters of intestinal mucous membrane.†

These strictures, so similar in position and in anatomical relations, were probably the result of an abundantly developed valve of the duodenum; that in the second case becoming more obstructive as the infant grew, on the principle that orifices in membrane or soft tissues, the result of diseased action, generally acquire a tendency to contract towards their centres.

Such cases are interesting, but are quite beyond the reach of treatment.

2. Obstructions, the result of foreign bodies lodged in the intestines, have already been considered in the essay on INJURIES OF THE ABDOMEN, vol. ii. pp. 465 et sqq.; we merely allude to them to complete the causes of obstruction in our table.

3. Twisting, "dislocation," or displacement of intestine, producing obstruction to the passage of its contents, is not a very common accident, but demands very careful examination when it occurs; for not only is its origin peculiar and its symptoms often obscure, but its treatment is a matter of very great consideration.

"Incarceration may be the consequence of a rotatory movement, and of this there are three varieties:

"a. A portion of intestine may have become twisted upon its own axis; and we then find that even semi-rotation causes such an approximation of its parietes, that they touch, and close up the passage. This can probably only occur in the colon; and according to cases on record, only in the colon ascendens. Accumulation of gas, and unequal filling of different portions of the intestine, appear, as far as we are able to judge from the few cases which have been noticed, to be the cause. Such an occurrence is scarcely

* *Pathological Trans.* vol. xii. p. 101. From the plate which accompanies the description given by Dr. Wilks, it would appear that the contraction in all probability arose from a highly developed valve of the intestine; in the centre of this valve, or stricture, may be seen a very small circular hole, apparently not larger than would admit a probe.

† *Ibid.* vol. xii. p. 121.

conceivable in the small intestine, on account of the uniformity of its calibre, the absence of angular flexions, and its loose position, as every rotation of one portion upon its axis would be counterbalanced by the rotation of the next segment.

"b. The mesentery may be the axis, and the intestine will then be rolled up upon the former; *i. e.* the entire mesentery, or a portion of it, is twisted into a cone; and in proportion to the number of its rotations, more or less of the intestine will be dragged after it. In this case, we must take into consideration the traction and the pressure which the dependent mesenteric cone forms with the base whence its point rises. This variety can scarcely occur any where but in the small intestine and its mesentery.

"c. One portion of the intestine, either single or double—a coil—may afford the axis round which another portion with its mesentery is thrown, so as to be throughout in contact with the circumference of the axis, and thus to compress it like a ferule. This variety is evidently a higher degree of the first, in which a portion of the intestine is merely compressed from before backwards, and, as it were, flattened down. A coil of small intestine, the sigmoid flexure, or the cæcum, may form the axis.

"The last two varieties occur, like the first, chiefly at an advanced period of life. In early life, a predisposition to the affection may be caused by a congenital malformation of the mesentery, by large herniæ, or by small herniæ when there is adhesion of the intestine."*

It is a matter of some importance to be reminded of, that the seat of *most* incarcerations, *and of all twists*, will be found towards the posterior unyielding wall of the abdominal cavity; for it is only in that direction that pressure exerted on the intestine can effect its incarceration; the occurrence of a similar relation anteriorly is inconceivable, on account of the smoothness and yielding nature of the parts.

The symptoms of twisting of the intestine, especially of the sigmoid flexure (which is the most common variety), are very urgent from the first; great pain is suddenly experienced in a small circumscribed spot of the abdomen; obstinate constipation usually setting in from that date. If the sigmoid flexure is implicated, there soon follows very considerable distension of the abdomen, often distinctly observed to be chiefly confined to the left side. The distension of the abdomen is generally much greater when the large gut is affected, than when the twist implicates the small intestine. In the latter conditions, fluids may be injected into the rectum very readily, and may remain, or return tinged by faecal matter. In twists of the sigmoid flexure, we have injected fluids into this division of the bowel; if retained for a time, they do not return; the fluid has been thrown into the dilated sigmoid portion, and cannot again escape; vomiting is generally present, and often very copious and constant.

The following cases illustrate the history and pathological conditions of these accidents.

A man, æt. 28, having suffered for five days from irremediable constipation, died five hours after admission into the hospital-ship *Dreadnought*. The sigmoid flexure occupied nearly the entire portion of the front of the abdominal cavity, and was in a gangrenous state. The bowel was immensely

* Rokitansky, *Path. An.* vol. ii. p. 52.

distended; obliteration of the muscular bands, and rupture of the serous coat, having taken place. This portion of the gut had been originally highly developed, and had now become strangulated, from falling over on itself towards the right side, causing a twisting and strangulation. The patient had, on previous occasions, been subject to constipation.*

A man, æt. 65, was admitted into St. George's Hospital with a large circumscribed swelling, which occupied the greater part of the abdominal cavity, and apparently extended into the pelvis. Fluctuation could be distinguished over the whole of the tumour, the surface of which appeared smooth. No solid matter could be detected in any part of it. Percussion gave a clear sound in the upper part of the abdomen only, and there but to a small extent. *There was a tendency to diarrhœa.* A day or two after admission, peritonitis came on, with great pain in the abdomen and constant sickness. He died on the fifth day. The greater part of the peritoneal cavity was occupied by a large dark-coloured tumour, which had displaced the various viscera, and encroached upon the chest. This mass was formed of the sigmoid flexure enormously distended. The dilated bowel was connected to the left iliac fossa by a pedicle formed by an exuberant meso-colon, which was twisted upon itself, and had thus occasioned partial obstruction of the gut: the communications respectively leading into the colon above, and the rectum below, being small and tortuous. The sigmoid cavity was distended with fluid feces, and contained one or two hard masses. The mucous membrane was of a dark livid colour, but not ulcerated. Extensive evidences of peritonitis were present.

A man, æt. 55, was admitted into Charing Cross Hospital, nine days after almost complete obstruction of the bowels. A displacement of the bowel implicated the termination of the ilium, cæcum, and ascending colon. The latter was pressed upon and strangulated by the termination of the ilium and its stretched mesentery. Just at the part where the pressure was exerted, a gland in a calcareous state, as large and hard as a marble, lay immediately under the strangulated bowel, and had considerable influence in exaggerating the obstruction, as every effort to force the contents of the gut onwards tended to carry the gland into the opening. Close above the constriction the internal coats were extensively ulcerated, and perforation was about to take place. In this case an attempt by operation was made in the left loin to relieve the obstruction during life, but without success, as the obstruction was above the opening made in the bowel.†

A boy was seized with a violent pain in the stomach, and with sickness. These symptoms continued, varying in intensity, with complete constipation. He died on the ninth day. The intestines were matted together. The duodenum, jejunum, and ilium were greatly distended; the lower part of the small intestine was highly inflamed, and two loops of it were quite black from congestion. The mesentery of these loops had been twisted on itself, and had caused strangulation of the gut attached; and while in this state, the folds had fallen on an intestinal diverticulum proceeding from the small gut to the linea alba, about one inch below the umbilicus, and thus gave rise to an additional amount of mechanical obstruction to the circulation and contents of bowel.‡

These cases are apt illustrations of the usual forms of "twist" of the bowel, such as occur, 1. in the sigmoid flexure; 2. about the cæcum; 3. of the small intestine. As a rule, such twists, when found in the small bowel, are usually nearer its lower than its upper extremity.

Rokitansky has very justly observed that the *predisposition* towards incarceration from twisting of the gut is dependent on a congenital, or acquired long, loose, flabby mesentery or meso-colon. But the mere existence of such a state, which allows very free movements of the bowel to take place,

* *Pathological Trans.* vol. i. p. 103.

† *Ibid.* vol. ii. p. 222.

‡ *Ibid.* vol. vii. p. 205.

is hardly sufficient to account for sudden strangulation of the parts taking place. It appears to us that something is requisite to establish the twist; and that this something is to be found in an accumulated mass of fæculent matter, invariably present wherever such twists occur. This accumulation of fæces, fluid or solid, so loads and distends the bowel, that if accidentally it becomes shifted into a position unfavourable for the free passage of its contents, the intestine has no power to recover itself; nor has its peristaltic action any influence in altering its position, or that of the contained fæces. The mischief once started continues to increase by continued inlets of fæculent matter, without any corresponding outlet; for it will frequently be seen that though fluid fæces from above can enter the sigmoid flexure when twisted, it rarely happens that much is able to escape into the rectum.

If, in the dead subject, the large intestine be distended artificially with water, and the mesentery of the sigmoid flexure be abundant, this portion of bowel is first seen to bulge forward, and then gradually rise up towards the diaphragm. In this movement there is a slight tendency observed towards a folding of the intestine on its mesentery; this when the abdomen is open, and no restriction applied to the bowel. We have not, however, been able, by simply distending the sigmoid flexure, to produce actual twist; but perhaps our experiments are too restricted; and no doubt some other cause is wanting to induce it besides distension and free movement. Something, perhaps, depends on the motions of the body, more perhaps on the presence of the other viscera and abdominal wall during life. The following particulars of a case bear strongly on this portion of our subject.

A man, æt. 45, was attacked on the 10th of November with diarrhœa. This ceased on the 12th. On the 13th he was occasionally sick, and complained of deep pain in the region of the bladder; and this pain became paroxysmal and severe until his death. Along the whole of the left side an unusually hard and broad ridge could be felt, extending from the region of the stomach to the bladder. Death took place on the 15th, almost suddenly.

The peritoneum contained a considerable quantity of bloody serum. In the epigastric region was seen the transverse colon, with the omentum stretched and adherent to the abdominal parietes, on the left of the umbilicus. The left side of the abdominal cavity was entirely occupied by the sigmoid flexure of the colon; it lay obliquely, and had forced the diaphragm high into the chest. The meso-colon, which was greatly thickened and elongated, had become twisted on itself, and the intestine with it. The gut was enormously distended by fluid fæces, and was livid, from almost complete strangulation of its coats and vessels at the seat of twist. Mr. Gay, under whose care this case fell, found on examination that, in the state of tension, if the bowel was partly untwisted and then relaxed, it sprang back forcibly to its acquired and altered position; but that this tendency became less as the bowel was gradually emptied of its contents, until it required little manipulation to restore the bowel to its natural position, and this without any marked disposition to again become twisted. He very justly remarks, *that usually the tightness of the twist is in proportion to the distension of the bowel.** A tube passed up the rectum after death in this case was with some little trouble introduced into the sigmoid flexure, beyond the obstruction, and could empty the bowel. When this was effected, and the body rolled over on the side, the twisted bowel righted itself.

The facts just quoted point to this rule in treatment, that relief in twist of the sigmoid flexure is just possible without opening the abdomen, provided the long tube can be introduced into the distended gut, its contents drawn off, and the twist be reduced by the altered position of the bowel. But no operation for the ultimate relief of the patient will be successful, without the intestine be unloaded first, and the twist then reduced. It may be stated as an axiom in these cases, that once formed, the twist prevents the escape of the

* *Pathological Trans.* vol. x. p. 153.

contents, and the contents of the twisted portion maintain the distortion ; and to remedy the latter, the contents must be removed.

It will be observed that in one case already mentioned, the serous covering of the intestine was found ruptured, after five days of constipation.* This rupture had no doubt occurred previous to death. In an experiment made to distend the large intestine with water, the peritoneal coat in several places ruptured, before the muscular appeared inclined to give way under the pressure. This rupture of the peritoneum appears usually to commence over the transverse colon, and other portions are subsequently affected if the distension is continued.

This tendency of the peritoneum to rupture in sudden distension of the bowels, in cases of obstruction, points towards the importance of early interference, if any operation be considered beneficial. When peritonitis has set in, in consequence of rupture of the serous membrane, or any other cause, operative interference is too late to be followed by any prospect of success.

4. Obstruction of the intestines occurs from a portion of bowel being strangulated in a loop, or bound down by a cord of false membrane ; or it may be constricted by a diverticulum, adherent by its apex to some opposed surface of the viscera ; or by the Fallopian tube, attached by its fimbriated process to some point of peritoneum ; or by a thickened and elongated piece of omentum fastened down at the ends by adhesions ; or by other accidental circumstances. All these conditions favourable to the occurrence of internal strangulation, are entirely or partly the results of inflammation and effusion of lymph.

5. Peritoneal pouches, which have usually well-defined rings for their orifices, and the foramen of Winslow—but this rarely—have been the seat of obstruction and strangulation of the bowel.

The causes of obstruction mentioned in the two latter divisions are attended by symptoms entirely similar, and only require to be separated as regards their pathological conditions, but in treatment may be considered under one head. However, those cases which are due to the products of inflammatory action may occur at any time of life, but most frequently in the young, are very uncommon in old age, and are often found in children ; whereas strangulation by a mesenteric pouch is usually observed in advanced life.

Females are rather more liable to internal strangulation ; for the appendages of the generative organs offer additional points for adhesive inflammation, and, consequently, entail so much more danger. In most, if not in all, of the conditions now under consideration, the small intestine is usually alone implicated.

The history and pathology of internal strangulation caused by false membranes and adhesions producing loops, &c., are best illustrated by the following cases :

A preparation in the Museum of St. George's Hospital shows the forma-

* See p. 157.

tion of a short band of lymph, adherent by one extremity to the free surface of a portion of small intestine; from this the band is seen to pass over another portion of small intestine, and then is immediately attached by the other extremity to the mesentery supporting the latter piece of bowel. As the effused band of lymph contracted, it so pressed on the portion of intestine which was crossed by the band, that entire stoppage of the bowels was produced.

A young lady, æt. 19, died after a few days' symptoms of strangulation and vomiting. The omentum was firmly adherent to the anterior abdominal wall. This was the result of old adhesions. The small intestines were greatly distended. At the lower part of the abdomen, on the right side, and dipping into the pelvis, a large portion of sphacelated intestine was seen. This was about five inches in length, and consisted of the ilium, which was constricted and strangulated by a ring formed by lymph which had been effused in some former attack of inflammation. The ring was so firm that it was obliged to be cut through to liberate the intestine. It was formed by the band of lymph being attached by one extremity to the inner surface of the caput coli and stretched across to the ilium, to which it adhered by the other.

A child four years of age died after five days' constipation and symptoms of internal strangulation. The cavity of the abdomen contained some serum thickly tinged with blood. At the lower part of the belly several convolutions of small intestine were highly congested and dark-coloured; this to the extent of a foot in length; and one portion of it was almost black in colour. This latter portion was found strangulated by a band of false membrane, which was attached by one extremity to the point of an appendix, by the other to the mesentery. The appendix was attached to the lower portion of the ilium, and about an inch in length, and communicating with the bowel. The appendix, and the band with its attachments, formed a complete ring about an inch in diameter.

A man, æt. 20, died after fourteen days' complete constipation. Near the termination of the ilium, a portion of it, nearly two feet long, much distended and much darker than the rest, was firmly constricted by a narrow band (not thicker than whipcord), which passed from the vermiform process to the ilium close to its mesenteric attachment.*

In a case in which a portion of small intestine was strangulated through a loop in the great omentum, perforation of the bowel had taken place, and had allowed the escape of fæces.†

A man, æt. 68, was admitted into St. George's Hospital 7th March 1861. He had been lifting some heavy iron about eight days previously, when he felt a sudden strain, and immediate severe pain in the loins and belly. He passed a restless night; the next morning there was slight action of the bowels. He complained of pain chiefly in the belly and dragging at the umbilicus; there was also constipation from the second day of pain. Four days after the attack he first vomited; but now every thing taken was rejected. Skin cold, and eyes sunken; blueness of surface, and pulse small and weak; tongue dry and brown; abdomen enormously distended and tympanitic. No stricture could be detected through the rectum. An enema-tube would not pass readily beyond a short distance. Mr. Johnson decided to open the descending colon, with a hope to relieve the distension; but the bowel, when cut down upon, was found collapsed. The question of making an exploratory opening in the abdomen from the front was considered, but decided against. The patient died on the eleventh day. The small intestine was very vascular. At the lower part of the ileum, close to the ileo-cæcal valve, a band crossed the small intestine, forming a ring around the gut and the commencement of its mesentery. The origin of the ring was observed to spring from the sigmoid flexure, which was drawn over to the right iliac region so as nearly to touch the cæcum. The tissue forming the ring was loaded with

* *Path. Trans.* vol. ii. p. 62.

† *Ibid.* vol. i. p. 259.

fat, closely resembling the structure of an epiploic appendix. The other appendices were very long and broad, and some were perforated at their base, and presented an incipient condition of such a ring as had embraced the intestine. There could be little doubt that this ring was either formed in an appendix, or was formed by the adhesion of two neighbouring appendices. The gut, where it was bound down, was deeply marked by the stricture. From the stomach to the situation of the obstruction the bowel was greatly distended, but more particularly at the lower part, where about a foot in length was stretched so tight that it burst under a stream of water thrown in to wash it out; and was nearly black from congestion. The constricting band was not adherent to the intestine, and after removal from the body the gut could be easily moved backwards and forwards in the ring. The position of the obstruction was immediately over the right common iliac artery. The cæcum and upper part of the large intestine were of the natural size, and contained fæces; the transverse and lower portion were empty and contracted.* The external wound was just below the left kidney.

Strangulation of bowel through the foramen of Winslow is most rare. We cannot point to any case within our own experience.

Obstruction caused by bowel becoming entangled or caught in a mesenteric or meso-colic pouch is not so unfrequent.

A specimen of meso-colic hernia, which had not been attended by strangulation of the bowel, was exhibited at the Pathological Society, by Dr. Peacock, in 1849; having been removed from the body of a man æt. 30. The left half of the transverse colon was deflected in a longitudinal direction, down the middle line, to the brim of the pelvis, and pushed forward by a large swelling, which projected on each side of the displaced colon. None of the small intestines were to be seen; but were found concealed in the swelling. This proved to be a large pouch formed by a fold of the meso-colon. It was opaque below, but the convolutions could be detected through it at the upper portion. The jejunum entered the pouch at the upper and posterior part; and the ileum passed out below and on the right side, about two inches above the termination of this portion of the intestine. There was no evidence of constriction of the bowel; nor did the displacement appear to have been productive of any inconvenience or disorder.

A second similar case was attended by strangulation of the intestine, and death. A man, æt. 27, was seized with pain in the abdomen, and vomiting. He vomited every thing taken, and the pain in the stomach was most severe. He died about forty-one hours after the commencement of the attack. The descending colon was found lying on the left side of the cæcum, and the small intestines were contained in a large pouch formed in the left meso-colon, and situated on the left side of the corresponding large gut. The ileum passed out of the pouch about two inches above the cæcum, and at that point the bowel was contracted, thickened, and gangrenous.†

6. Invagination, or intussusception of the bowel, is often the result of irritation caused by worms; of tumours attached to the mucous membrane; and of other accidental causes, not always to be detected or explained.

Invagination may frequently be observed in the post-mortem examinations of children. It also often takes place in grown-up persons of both sexes, and may occur in almost every part of the intestinal canal.

It may occur in one or in several parts of the bowel

† *Path. Trans.* vol. ii. p. 60.

at the same time in the same individual; but we take it to be almost certain, that when obstruction occurs, it is the result of one extensively invaginated portion of gut; and that when in post-mortems several are met with, they are but slight, and have not been productive of urgent symptoms during life.

A preparation in the Museum of St. George's Hospital displays a portion of small intestine invaginated, apparently from the irritation set up by an *ascaris lumbricoides*, which may be seen coiled round the prolapsed portion. But many other parts of the bowel were also invaginated; and when the patient died, the state of the bowel was not suspected.

The anatomy of intussusception is interesting; we must devote a few words to its conditions.

The usual form of intussusception met with is an inversion of a portion of intestine into the tube of the gut immediately below. But the relative conditions of the upper and lower portions of the bowel may be reversed; the intestine below may be projected into the intestine above, and this would still constitute an intussusception. This latter state must, however, be quite exceptional, even if it ever occur. The former is common and often fatal.

A perpendicular section through an invagination will display on each side, and lying parallel with each other, three layers of intestinal wall; a transverse section would show three rings of intestine, one within the other. In each section, whether perpendicular or transverse, the opposed surfaces of the intestine will correspond in character; peritoneum will touch peritoneum, and mucous membrane be in contact with a similar tissue. The outer surface of the external layer is of course peritoneum; the lining of the inner layer is of course mucous membrane; but between these there are two opposed surfaces of mucous membrane, and two likewise of peritoneum. Between the inner and middle layers, and in the space lined by peritoneum, will be a certain portion of mesentery or meso-colon dragged in by the inner layer of bowel as it becomes prolapsed. The limit of the invagination above is at the outer, or peritoneal surface of the bowel, and consists of an obtuse edge, formed by the folding in of the intestine at that point. The lower limit is inside the tube, and can only be observed when the gut is laid open. The portion of intestine which receives the invagination is a single layer; the invaginated portion, that which slips into the former, consists of two layers of bowel. A portion of mesentery will be found between these two layers, its size and shape varying with the length of the prolapsed intestine. The lowest extremity of this impacted mesentery is almost drawn to a point, and is near the extreme lower part of the prolapse. The mesentery is thicker and broader where it enters the fold between the two layers of intestine, so that it becomes somewhat triangular in shape as it lies between the two layers of intestine already alluded to. As the mesentery is attached to one margin of the bowel, the bowel in prolapsing is somewhat retarded by the mechanical action of the former; for the mesentery, being always in a state of tension, drags upon one side of the prolapsed bowel; it will therefore be found, especially in an extensive prolapse, that the prolapsed end of the gut, its inner extremity, is turned in the direction of the attached mesentery; from which circumstance the piece of bowel presenting the prolapse will be found slightly curved to one side, and thus the whole mass assumes a crescentic figure.

Rokitansky, in referring to this condition, makes the following important remarks. "Firstly, that the invaginated portion does not lie parallel with its sheath, but always offers a greater curvature than the latter, the inverted tube being compressed on its concavity into tense transverse folds. Secondly, that the orifice of the invaginated portion of bowel does not lie in the axis, or in the centre of the sheath, but towards the side; and that, following the traction exerted upon it by the mesenteric fold that belongs to the inverted

intestine, it is directed towards the mesenteric wall of the sheath; that the opening is not circular, but represents a fissure. This affords a diagnostic sign for the examination of intussusceptions of the rectum, which are within the reach of manual exploration.*

Invagination may go on to involve a large portion of the small, and the greater portion of the large intestine. When an intussusception increases in size, the *involution* is that of the bowel below the commencement of invagination; if this commences at the lower part of the ileum, more of the upper ileum does not disappear, but the prolapse grows in length at the expense of the inferior portion of the intestine, cæcum, ascending colon, &c.; each of which in turn would become folded in, as the prolapse increased.

We do not attempt to explain the causes of intussusception. In all probability, an empty state of intestine, and some irritating cause under such conditions, are essential to its production.

If invagination increases beyond a slight extent, a change will soon occur in the condition of the implicated piece of bowel; which, we may predict, places it beyond hope of reduction, accidental or applied. From the pressure exerted on it and its mesentery, congestion, followed by inflammation, soon commences. The result of this condition is a more than natural secretion from the mucous surface, and often a bloody discharge mixed with mucus. This is a symptom of some importance in the diagnosis of intussusception. The whole mass then becomes thickened, and peritonitis usually commences about the upper part of the invagination, and extends more or less over the general surface. This onset of peritonitis is usually sufficient to insure adhesion of the opposed surfaces of the peritoneum, at the entrance or upper ring of the sheath. At this line there will also be a certain amount of strangulation exerted upon the portion within the ring; the first step in the effort made by nature to remedy the evil, now rendered irreducible, so that the prolapsed portion be cast off presently by slough; and that the escape of the contents of the bowel be provided against, by the union of the upper and lower portions of the otherwise severed intestine.

Peritonitis of a severe character usually occurs when a large portion of intestine is involved, and soon carries off the patient; but should he survive this attack, he may yet recover. The involved portion may slough, and be passed by stool, and the patient rise from his bed convalescent in a few weeks.

The further history and treatment of intussusception is best illustrated by the following cases.

A boy, nearly five years of age, complained of soreness about the anus, the result of ascarides. The next day he was seized with sudden pain in the lower part of the abdomen, and strained several times at stool, but passed nothing. He soon afterwards vomited. He continued to go to stool every half hour. In the afternoon he experienced constant desire to go to stool, and passed a clot of blood. On some of these occasions he passed dark-coloured blood and slimy matter. There was great restlessness, and thirst. The abdomen was more swollen above than below the umbilicus. There was much tenderness over it on pressure. The symptoms continued unrelieved, and death took place on the fifth day. A considerable intussusception had occurred of the ileum through the ileo-cæcal valve; the appendix was also carried in. About $3\frac{1}{2}$ inches of bowel protruded into the cæcum. The involved part was of a deep-red colour. It was so firmly grasped by the ileo-cæcal valve, that the effort to reduce it appeared likely to tear the bowel.†

A child, six months old, died after sixty hours of suffering from vomiting and discharge of bloody mucus from the rectum. The whole of the colon, ascending transverse and descending, had passed into the sigmoid flexure. The mucous membrane of the prolapse was purple from strangulation.‡

* *Pathological Anatomy*, vol. ii. p. 55.

† *Pathological Trans.*, vol. ii. p. 55.

‡ *Ibid.* vol. ii. p. 56.

The two foregoing cases mark the prominent symptoms of acute invagination of intestine; sudden pain; constant and urgent desire to stool, with little faecal matter passed, but blood in clots or bloody mucus escaping in small quantities; more or less vomiting; great distress, both general and local; and death following in a few days. But death may be somewhat sudden. A sailor, during a railway journey, was observed to place himself on the floor of the carriage, but had no attention paid him by his fellow-passengers. At the journey's end he was found dead. The abdomen presented marks of severe peritonitis. A fold of intestine near the termination of the ileum, six inches in length, was intussuscepted and gangrenous. Probably in this instance the mischief was of some few days' duration.*

In other instances the symptoms appear to extend over a much longer period, and ultimately prove fatal; or if the strangulated bowel slough off, may terminate favourably.

A man, æt. 25, suffered from attacks of colicky pains in the abdomen, and gradually lost flesh. One day he became suddenly worse, and on the following day died; nearly four months from the supposed date of the commencement of his attack. About six inches of ileum, cæcum, and the first part of the ascending colon, had passed into the large bowel beyond. There was no appearance of gangrene in any part. The colon contained much mucus and coagulated blood. The mucous membrane was turgid and purple. The involved layers of the intestine were firmly adherent to each other by dense bands of false membrane.†

Recovery after the passage of the strangulated portion of the bowel through the rectum is the only fortunate result that we can anticipate in a case of chronic intussusception, and fortunately is a result which occasionally takes place; nor does the loss of the bowel appear to be attended by any subsequent evil consequences, *i.e.* contraction or stricture of the gut, so far as we have been able to investigate the subject.

A boy, æt. 5, was taken ill four months previously to the time at which a mass of bowel was passed. At first he suffered from simple fever, but afterwards experienced much distress. He complained chiefly of pain in the region of the bladder; but there was no tenderness. The urine was sometimes retained for a long time. The bowels were very much confined, sometimes for fifty hours. There was occasional vomiting. He was never known to pass blood. *Eight inches of the ileum, the cæcum with its appendix*, and about four inches of the colon, were passed by stool. The tissues were almost black, and offensive. Diarrhœa preceded the discharge of the separated bowel. At the end of six weeks from this event the little patient seemed quite well, and the bowels acted regularly.

This case occurred in 1847, under the care of Mr. Hesilridge Buckby, of Sutton-on-Trent. In September 1863 he kindly wrote to the author to the following effect: "I have much pleasure in informing you my little patient

* *Path. Trans.* vol. i. p. 77.

† *Ibid.* vol. vii. p. 193.

has continued *in perfect health* ever since his restoration. I saw him the other day."

V. T., æt. 18, was seized with severe paroxysmal pain in the abdomen. This continued and increased without relief; and was followed by stercoreaceous vomiting. Symptoms of general peritonitis came on, without any relief from the bowels. The more urgent symptoms were relieved under the use of calomel and opium; but no evacuation was obtained. On the tenth and following day enemata were returned without any fecal tinge. On the twelfth day some feculent matter was brought away; and more feces passed after a dose of castor-oil. On the nineteenth day he had three motions. The last consisted of bright florid blood, mingled with many portions of the small intestine. The two previous motions were said to have been of precisely the same character, and to have contained many "skins." At the expiration of six weeks the patient returned to his usual occupation.*

In the Museum of St. George's Hospital is a preparation which shows an intussusception caused by the presence of a tumour growing from the wall of the bowel and projecting into its cavity. A process of sloughing has nearly detached the prolapsed portion from the rest of the intestine, and so almost set free the tumour. The patient died of peritonitis.

Peritonitis may be the result of perforation of the bowel during the separation of the sloughing prolapse; in which case death is generally rapid, and attended by acute pain and much suffering.

The average number of deaths from intussusception, taking all ages, must be very small. In five years there were admitted into the Hospital for Sick Children, in-patients 1920, out-patients 46,298—total 48,218. Only one death from invagination of intestine occurred during those five years among this number of patients.

It will appear that, although invagination has been classed with the causes of acute strangulation, many cases occur in which these symptoms are not very acute, and last some time, or even terminate in recovery, though at a sacrifice of a portion of the bowel.

Invagination may be suspected when there are present acute pain, sudden in its attack, and confined in extent; constant and urgent desire to stool, without any relief, with the passage of blood and mucus; and sometimes a swelling, sausage-like in shape, may be felt in the ileo-cæcal region; with constipation and vomiting. No age is exempt from it; but children are most liable to its occurrence. The pain in such instances is often intermittent: when present, the child doubles itself forwards, and often rests its head on the bed, kneeling.

The treatment should chiefly consist of opiates; with the addition of calomel when peritonitis sets in, and leeches to the part in pain. The proposal to open the abdomen should not be entertained. The cases recorded will justify this opinion. And if general measures give no relief, we have only the one hope left, that the involuted portion may be thrown off by slough, and thus the obstruction be removed.

Distension of the lower bowel with fluid or air has been recommended, and even stated to have been successfully applied in cases of urgency; but

* *Pathological Transactions*, vol. vii. p. 199.

however plausible the effects of this kind of treatment may appear, it must be recollected that, even when the abdomen has been opened, there has been difficulty, and in some cases almost an impossibility, to reduce the involution without tearing the bowel. A case is, however, recorded by Dr. Baldwin of Florida, of recovery in supposed invagination, treated by injecting a very large quantity of fluid into the rectum.*

We have now to consider the more chronic conditions productive of obstruction.

1. Habitual constipation may become accidentally prolonged to such an extent as to cause anxiety; or the accumulation of faecal matter may be mistaken for a tumour, so circumscribed occasionally is the collection in the large intestine. The time that may elapse while the bowels are entirely closed, and the amount of faeces that may be collected therein, would surpass belief, were it not that the experience of those now living can confirm the statements made by writers on this subject.

A lad, æt. 7, on recovering from an attack of fever, was affected with great torpor of the bowels. This gradually increased to such an extent, that in two years treatment failed to have any effect. When admitted into the Free Hospital, under the care of Mr. Gay, *nothing whatever had passed from the bowels for three months*. The health had not suffered; the appetite was good. The body was greatly enlarged, and was forty-nine inches in girth; and there was inconvenience to respiration. There was considerable prominence on the left side, as if the colon and sigmoid flexure were chiefly loaded.

A speculum was passed into the rectum, and after dilating it, an enema-tube was passed high up. The contents of the bowel were washed out by a stream of warm water kept constantly playing upon them for half an hour at a time. A large quantity of hard black faeces, like cinders, was brought away. These measures repeated several times reduced the girth of the abdomen to twenty-six inches.†

The Surgeon is usually consulted at the latter period of obstinate constipation, which has at last arrived at complete obstruction of the intestine; and as all power of propulsion is then lost, the contents have to be removed mechanically. This can only be done by the aid of repeated warm-water enemata; or by means of some kind of scoop or short lever, with which the lowest masses of hardened faeces should be carefully dislodged.

Purgatives in such cases are not of much use, until the load is somewhat reduced in the lower bowel.

The following very instructive case is mentioned, in a letter to Dr. Burne, by the late Dr. R. Williams, Physician to St. Thomas's Hospital. A lady, æt. 35, was attacked with severe gastrodynia, and most obstinate constipation. Paroxysms of the pain recurred at short intervals, gradually became more frequent, and at length quotidian. Each meal was followed by pain so severe and continued, that she limited herself to dry biscuit and brandy-and-water; and this was commonly rejected. Nothing gave relief but opium, of which, for months, she took not less than sixty grains daily. Her bowels, independent of the astringent effects of opium, were always greatly constipated; and no quantity of salts, oil, or senna in the least moved them: elaterium, croton-oil, or other powerful purgatives, immediately inverted the action of the stomach, and were rejected. Calomel was the only medicine that would act upon the bowels, and this not until her mouth was affected.

* *American Journal of Medical Sciences*, Oct. 1852, p. 568.

† *Path. Trans.* vol. v. p. 174.

From this cause she frequently had no evacuation for *six weeks* together; and in one year, when much weakened by repeated salivation, so that it was necessary to defer the administration of the calomel as long as possible, she had only one evacuation every *three months, or four in the year*.

At the times her bowels acted she suffered immensely, her pains being more severe, if possible, than those of labour. The faecal matter when passed was enormous in quantity, healthy in colour, and was formed into large round lumps or scybala, each certainly not less than a large foetal head, and so numerous as often to fill a common-sized pail.*

We may, perhaps, have travelled somewhat from the path of our especial calling, in introducing the latter cases, illustrative of chronic obstruction of the intestine. But the accumulation of large quantities of faeces is often productive of a strange and anomalous train of symptoms; often such as indicate structural obstructions; or simulate morbid growths in the abdominal cavity. Experience, discrimination, and careful examination are often requisite to insure a correct diagnosis as to the true nature of these collections: and without extreme caution, the Surgeon may be baffled in his attempts to unravel the conditions attendant on a loaded intestine, accompanied by obstinate constipation. With a gut greatly distended by faecal matter, and with the symptoms of organic obstruction, it will frequently happen that the bowels act freely, and yet without relief, or any reduction of the size of the abdomen. It is but the overshot of the sluice; the head-stream is dammed up; the canal is loaded to overflowing.

2. Obstruction, the result of injury, we need but allude to here. The conditions and treatment have been already described at vol. ii. p. 396.

3. Constipation, occasionally amounting to obstruction of many days' standing, or even of a fatal character, is apt to occur in cases of peritonitis, attendant on tubercular deposit in the subserous cellular tissue, or the result of other causes; a condition often accompanied by ulceration of adjacent and adherent surfaces of the intestine.† A direct communication thus takes place between two or more opposed surfaces of bowel: often an abscess is found within the abdomen, communicating, through ulcerated openings, with several portions of the intestinal canal; there is great irritability of the stomach, and often rejection of all food; an unyielding abdominal wall, and an irregularity of its surface; general but not exquisite tenderness; and constipation of, perhaps, some days' standing. Such symptoms might, at first sight, convey the idea that obstruction was due to some of the causes previously enumerated. But in

* Burne on *Habitual Constipation*, p. 28.

† An interesting case is recorded by Dr. Bristowe, *Path. Trans.* vol. viii. p. 200.

such cases as we have now under consideration, there are usually general indications of tuberculous cachexia long before symptoms of obstruction set in. The condition of the bowels is, however, as a rule, extremely uncertain in these cases; occasionally confined, but more frequently purged. With adhesion of peritoneal surfaces, and ulceration through the coats of the intestines, obstruction is rare; and is rather the exception, unless the calibre of the bowel is contracted by the pressure of abscess, or diminished by false membrane, or other media, stretched across the tube. Looseness of bowels is the usual condition in the cases just considered.

4. Stricture of the intestine is the most common cause of obstruction.

Strictures of the intestine occur under various conditions, independent of cancerous deposit in the walls of the gut. The chief causes of simple stricture are due to the action of caustic substances; to the presence of foreign bodies, causing ulceration and contraction; to tuberculous ulceration; to ulceration of the mucous membrane without any known cause; to the thickening attendant on old reducible hernia; and to an inflammatory action taking place in the walls of a portion of the intestine, terminating in the effusion of fibrin, and subsequent contraction of the canal.

Stricture, the result of disease of the upper portion of the small intestine, is rare. We believe, when met with, it usually follows cicatrization and contraction after ulcer, the direct effect of some escharotic accidentally or intentionally swallowed; or of some other form of ulcer which, in healing, has contracted the diameter of the gut.

Stricture of the duodenum is uncommon. We have met with a few instances of it. In the Museum of the College of Surgeons is a specimen of a stricture of the duodenum; the stricture is half an inch in length. It appears simple in its character, but has no history attached to it.*

The following case well illustrates the effects of an escharotic substance introduced into the stomach. A woman, æt. 40, accidentally swallowed about half a wine-glassful of "Burnett's solution" (chloride of zinc), and was immediately seized with violent pain and vomiting; but under treatment recovered from the immediate effects of the poison. A month afterwards, pain and vomiting returned; and in about two months after she was admitted into St. Mary's Hospital, under the care of Dr. Markham. All food taken was rejected; and she died about four weeks after her admission, and some three months after taking the fluid. In the pyloric portion of the stomach, about an inch and a half above the valve, the stomach was so contracted as only to permit the passage of a small bougie. The constriction was clearly the result of a cicatrix.†

A young lady had accidentally some "Burnett's fluid" given her instead of a dose of medicine. Acute pain and vomiting were the immediate result, and for many months life was despaired of; by degrees the stomach became

* Series xxiii. No. 1176.

† *Pathological Trans.* vol. x. p. 164.

more tolerant of food, and was able to retain small quantities of fluid nourishment, taken at frequent intervals. It is now some five years since the accident; but still the greatest care is requisite on the part of the patient as regards her diet. It can only be taken in a fluid form, in small quantities; and is generally required at intervals of four hours. Solid meat, or indiscretion in quantity of food, at once produces vomiting, and the contents are rejected. The health is in every other respect good. No doubt some contraction has taken place from ulceration, caused by the caustic applied to the pyloric extremity of the stomach or to the duodenum.

Stricture following other forms of ulceration is occasionally met with. A specimen of stricture of the ileum after ulceration is recorded by Dr. Bristowe. The ileum and lower part of the jejunum presented numerous ulcers, mostly cicatrising. At the commencement of the ileum a cicatrix had formed, and reduced the calibre of the intestine to such a degree that the point of the little finger could barely be inserted. Below, the bowel was contracted; above, it was considerably dilated. One slough, opening through the intestine, allowed the escape of fæculent matter into the peritoneal cavity. The intestinal wall at the strictured part was an inch thick. Throughout the large intestine were numerous cicatrising ulcers. The history of the patient did not throw any light on the case. For some years she had been liable to sudden attacks of pain and constipation.*

A man, æt. 54, had been poorly for twelve months. At the commencement of that period he had suffered from an attack of fever, since which he complained of pinching pain in the bowels; the abdomen became swollen; and he lost flesh. He could take very little food; was constantly sick, but the bowels acted once or twice daily. A constriction of the ileum was found at the junction of the upper with the middle third, dependent on great thickening of the walls of the bowel. The stricture was an inch long, and barely admitted the tip of the finger. Immediately above this, the bowel formed a pouch, the parietes of which were thinned almost to perforation. In this pouch were found thirty-three plum-stones, and sixteen cherry-stones, all perfectly black; and half a dozen recently-swallowed orange-pips.† There was an oblique inguinal hernial sac, into which it was evident, from the position of the parts, that the strictured portion of the intestine had been in the habit of passing.

These two cases are interesting when we examine into the causes of the strictures described. In the former one, though there was extensive ulceration of the bowel above and below the stricture, the symptoms, and the nature of the latter, incline us to believe that contraction of the bowel from cicatrix was the primary disease. In the latter case it is most probable, that inflammation, produced by the bowel frequently slipping into the old hernial sac, was the original cause of the stricture, quite independent of the attack of fever, or any ulceration of bowel following that attack.

In allusion to this consideration, viz. whether the ulcerations of intestine in fever are subject to contraction, and are thus productive of stricture, Rokitansky observes that the cicatrices "have occasionally been observed thirty years after the fever had occurred;" and he adds, "it is singular and characteristic of this ulcer and its cicatrix, that they never in any way give rise to a diminution of the calibre of the intestine."‡

Of the healing of ulceration, the result of tubercular infiltration, he further observes: "In consequence of the contraction of the ulcer, a cicatrix

* *Pathological Trans.* vol. iv. p. 153.

† *Ibid.* vol. x. p. 154.

‡ *Pathological Anat.* vol. ii. p. 73.

forms on the surface of the intestine, which presents a more or less elevated ridge on the internal surface of the intestine. If the ulcer was of considerable size, or if it encircled the entire intestine, a callous annular ridge remains, which diminishes the calibre of the intestine, and when viewed from without occasionally gives rise to an appearance of invagination. Thus the healing of a tubercular intestinal ulcer is always accompanied by a diminution of the intestinal calibre."*

So, also, in the ulceration of the bowel under attacks of dysentery, he observes: "In cases of extensive destruction of substance, the approach of the edges is rendered impossible; the deeper layers of the tissue, which takes the place of the mucous membrane, is frequently condensed into fibrous bands, which form corded projections into the intestinal cavity, interlace with one another, and not unfrequently encroach upon the calibre of the intestine, in the shape of valvular or annular folds, thus giving rise to a stricture in the colon of a very peculiar form. This mode of regeneration is more remarkable, as it closely resembles that following the destruction of the œsophageal mucous membrane by mineral acids."†

A case of stricture of the sigmoid flexure, near its junction with the rectum, is reported by Dr. Peacock.‡ The contraction was apparently due to the cicatrix of an old ulcer. There was much thickening, puckering, and induration of the internal tunics. There was no appearance of any cancerous deposit. Immediately above the stricture the cavity of the intestine was very large, and an ulcerated aperture, of sufficient size to admit the passage of the thumb, existed on the anterior and inner side; a portion of fæcal matter had escaped into the cavity of the pelvis.

5. Obstruction may also be the result of stricture, dependent on cancerous deposit in or about the walls of the intestine. Less frequently, it is occasioned by tumours or cysts pressing on the bowel: such as fibrous tumours of the uterus; ovarian cysts; hydatid growths, or other masses, which originate in, and encroach upon, the abdominal cavity. The ultimate effects of most of these causes of obstruction are equally fatal. Their treatment must of course vary according to their conditions; but life may be prolonged many months under proper care and judicious management. Cancerous affections of the intestine usually run the most rapid course; but even in these cases life is occasionally prolonged much beyond the period which may at first be anticipated.

Cancer of the intestine occurs most frequently in the large bowel. When the small intestine is affected, usually the disease has attacked it secondarily, having originated in some contiguous viscus. The nature of the deposit varies much in different cases: true scirrhus, medullary deposit, or villous growth, will each be met with; but the latter less frequently than the former, and true scirrhus less often than the medullary form of cancer; but, as Rokitsansky justly observes, they "may be combined with one another, from their first origin, or consecutively."

"The colon," he continues, "is almost exclusively the seat of cancerous degeneration; but there is a gradation in the proclivity of its different sections to the affection. The rectum is most frequently attacked; in second order, the sigmoid flexure; and the remaining portion of the colon but rarely. . . . Carcinoma occurs as a primary affection of the intestine in three forms. Firstly, in the mucous membrane, as carcinomatous infiltration of the erectile tissue, into which the former has been previously converted—fungus;

* *Path. Anat.* vol. ii. p. 96.† *Ibid.* p. 87.‡ *Path. Trans.* vol. xiii. p. 97.

secondly, more frequently in the submucous cellular tissue, as round nodulated accumulations; thirdly, most commonly as an annular deposit of the cancerous tissue in the submucous cellular layer.* And he adds, that "cancerous stricture of the intestine is the most common variety of stricture that results from alterations in the intestinal coats, and at the same time the one that advances to the highest degree."

The following case illustrates the history of such a stricture :

A man, æt. 58, was admitted, under the care of Mr. Birkett, into Guy's Hospital, with constipation, which had existed for a week. Twelve months previously the patient had been attacked with diarrhoea, sickness, and great pain over the whole of the abdomen. The diarrhoea ceased, but the attacks of sickness and pain recurred at intervals. He lost flesh. The bowels were sometimes costive, at others relaxed. He became gradually worse in every respect, and then sought admission into the hospital. At this time he had constant nausea; frequent vomiting every two or three hours, and always after taking food. The abdomen was tense, but not tympanitic. There was a swelling in the right inguinal canal, but no hernia could be detected. Two days after his admission, as the symptoms were not relieved, Mr. Birkett cut down upon the old hernial sac; but no intestine was found in it. The symptoms became gradually more distressing, and the patient died about four days after admission. The right flexure of the colon was constricted, as if a string had been tied round it. "Within this constricted part, a growth was seen attached to the anterior wall of the bowel; and was of the nature described by Rokitansky as 'villous cancer.' "†

Malignant, or cancerous deposit, productive of stricture of the intestine, though usually found to affect persons past the meridian of life, may occasionally be met with in youth.

A boy, æt. 15, was the subject of a stricture of the rectum from three to four inches from the orifice of the bowel. The stricture was very tight, and accompanied by ulceration of the mucous membrane. The stricture was caused by the deposit of medullary cancer external to the muscular fibres of the gut. The patient died of acute peritonitis.‡

Advanced age generally appropriates to itself those forms of intestinal obstructions which take their origin in cancerous deposits. From the pylorus to the ileo-cæcal valve, from the cæcum to the rectum, there is no portion invulnerable to their attacks. Occasionally they are found to affect the duodenum; somewhat oftener the jejunum and ileum; most commonly the lower portions of the large intestine. If medullary stricture be found in youth, the rectum is almost invariably the seat of the mischief.

The pressure of a fibrous tumour has been known to produce obstruction. An ovarian cyst may occasion stoppage of the bowels. A woman was admitted into the Middlesex Hospital, under the care of Mr. Moore, suffering from constipation, and at the same time was the subject of a large ovarian cyst. The constipation did not yield to treatment until the fluid of the cyst was withdrawn, when entire relief was afforded to the symptoms of obstruction.

* *Path. Anat.* vol. ii. p. 97.

† *Path. Trans.* vol. iv. p. 154. The preparation is illustrated by an excellent engraving in the *Transactions*.

‡ *Ibid.* vol. i. p. 67.

Spasmodic strictures, as they are termed, appear to depend on disordered or costive bowels; and need no comment from us.

Before entering upon the consideration of the treatment of obstructions of the intestines, it appears to us desirable, 1st, to attempt some kind of estimate of the periods of life at which different kinds of obstruction may occur; 2d, to review generally the respective symptoms dependent on those various organic or accidental conditions; and 3dly, to determine under what circumstances, and with what hopes, operative interference may be adopted.

As regards our first proposition, we have arrived at the following, rather general, conclusions: that obstructions occur in the following order of frequency, from the various causes mentioned, in youth, middle life, and old age: viz. in youth, from internal strangulation by bands of lymph, omentum, or adherent diverticula; from adhesions of various coils of bowel to each other; from intussusception; from foreign bodies taken by the mouth; from cancer, rarely, and hitherto found in the rectum only:—in middle life, from twists of large or small intestine; from gall-stones, intestinal concretions, and foreign bodies; from intussusception; from simple stricture; from mesenteric hernia; from internal strangulation by bands, &c.; from peritonitis, often resulting in abscess; from simple constipation; from cancer:—in advanced life, from cancer; from thickened intestine, the result of old reducible hernia; from intussusception; from simple stricture; and lastly, from internal strangulation.

The following table indicates the relative frequency of different causes of obstruction irrespective of age. The results are taken from Mr. Hinton's valuable communication on intestinal obstructions.*

In 135 cases, the following were the causes of obstruction, in the order of their frequency :

Diseased uterus	1	In first col.	26
Stricture of ileum	1	Doubtful	8
Cancer of small intestine	2	Peritoneal adhesions, tubercles, &c.	9
Internal hernia :		Stricture of sigmoid flexure	10
Inguinal, high up	1	Ditto colon	11
Diaphragmatic	2	Ditto rectum	11
Meso-colic	2	Intussusception	24
Obturator	3	By bands, adherent diverticula, uterine appendages, &c.	36
Fæcal accumulations	3		
Twist of sigmoid flexure	4		
Concretions, calculi, foreign bodies	7		
	26	Total	135

From whatever cause obstruction has its origin, the symptoms in

* *Medical and Surgical Association*, 1853, p. 431.

most cases are commonly so similar, that a correct diagnosis as to the exact seat of the block is not to be expected. We may, however, by careful inquiry and examination, approach near it. But whether occasioned by intestine entangled in a loop, or fissured omentum; by a cicatrix, or simple stricture; by a foreign body; or by a twist contracting the gut,—the symptoms do not vary much in character, though they will in degree and in the period of their commencement and sequence. Constipation and pain, vomiting and tension of the abdomen, each and all may be present; and should be present, to constitute the conditions of absolute obstruction.

But we are of opinion that intussusception should be excluded entirely from the above general observations. The usually early and marked symptoms of invagination are sudden, often acute, pain, as severe as it is sudden; constant desire to pass motions, and perpetual attempts made to this purpose without any relief. Most commonly there is discharge of blood mixed with mucus, or pure blood in a fluid or clotted form. From no other cause of obstruction have we seen such perpetual desire to stool in the early part of the attack; nor, with such attempts, the passage of blood and mucus. Sometimes a small quantity of *faeculent* matter is mixed with the mucus, but often only enough to colour the discharge.

Intussusception, again, is the form of obstruction which occurs earliest in life. We have known it occur in an infant at the breast between five and six months. Mr. Hinton mentions a fatal case at the age of two and a half months.

In men affected with intussusception, similar symptoms are observed. The disease is more rare in old age; the oldest of which we have a record was in the fifty-sixth year. The symptoms attendant on obstruction from other causes will vary according to the completeness of the strangulation, or block. In all internal strangulations, by bands, &c., the symptoms are usually very acute; the pain is sudden, sharp, even agonising occasionally; vomiting sets in early, and is usually incessant; the distension may not be as great as in the more slowly-operating causes of obstruction, since little food can be taken, but still the small intestine becomes much loaded; there is generally great tenderness on pressure, for usually peritonitis is not long absent; there is early evidence of grave constitutional damage, for the portion of intestine, tightly bound down or encircled at the strictured part, soon thickens and inflames, or may blacken and mortify.

In twists of the large bowel; simple stricture, or cancerous contractions; foreign bodies; loaded intestine; abscess of abdomen;

and other chronic causes of impediment, the symptoms may vary to some extent, and in most of these instances may present themselves gradually.

Constipation, more or less difficulty in defæcation, small long thin or flattened motions, constitute the primary and alarming symptoms of commencing stricture. The belly becomes distended by degrees, as the obstruction increases; pain follows upon the increase of contents; often transient periods of diarrhœa occur. Vomiting is frequently absent till quite a late stage. Of course something depends on the position of the obstruction. If it occurs in the upper portion of the intestinal canal, vomiting occurs early in the case, and distension of the abdomen is less marked. If in the lower bowel, sickness sets in late, but great accumulation may occur in the large gut, and the peritoneal coat be in consequence ruptured before death, unless timely relief be afforded.

The examination of the general surface of the abdomen does not often convey much, if any, idea of the exact seat of the obstruction, unless it be caused by a tumour in that cavity. Occasionally, with a twist of the sigmoid flexure, the chief swelling has been observed on the left of the umbilicus; but very little dependence can be placed on such evidence for a satisfactory solution of the exact cause or seat of the obstruction. The examination of the rectum often conveys more satisfactory information. The obstruction may be often here detected by the finger, or bougie; water thrown up may be immediately returned, or a small quantity may be retained, sufficient to indicate that a stricture, not to be detected by the finger, exists higher up.

A long tube passed up the rectum may frequently detect the actual obstruction; but it is often apt to deceive us as to the seat of the stricture. It is, however, always desirable, in all cases of obstruction, to attempt its introduction as far as possible without any force, and to inject warm water frequently and plentifully, if any fæcal discharge accompanies the return of the injected fluid.

The cachexia which usually marks the presence of cancerous deposits, the existence of fæcal fistulæ in the abdominal wall, the bladder, or the vagina, are symptoms of frequent occurrence in cancerous stricture. Hepatic pains of previous years, or months, the symptoms of former mischief about the gall-bladder, point towards the supposition that a biliary calculus may have ulcerated into the duodenum, and produced the obstruction by blocking up the canal. Concretions, the offspring of particular kinds of food,

the stones of fruit, or substances swallowed under peculiar conditions of hysteria or mania, produce similar symptoms of obstruction.

The treatment of obstruction of the bowels is a question of the deepest interest. Notwithstanding the experience of recent years, it must ever be regarded with anxiety, as it will always be subject to much discussion. There is too frequently a hopeless condition when the Surgeon is called in. Death occurs often so early in the scene, even in a constitution otherwise healthy, that the medical attendant has little time to propose, or the patient to acquiesce in, measures which involve life: it becomes therefore a matter of grave importance to decide upon rules for our guidance under such perplexing circumstances.

The subject is not a new one, and yet little notice has been taken of it in systematic works on Surgery. The detached writings of Callisen, Littré, Amussat, Phillips, Heven, Cæsar Hawkins, Curling, and others, have of late years drawn more attention to its consideration; whilst the experience derived from our hospitals, and the results of more recent operations, have to a great extent sanctioned surgical interference for the formation of artificial anus, when other medical treatment has failed.

In the management of this class of cases, purgatives should be scrupulously avoided. This is a precaution to be adhered to most rigidly at the commencement of the symptoms. But if there be one golden rule to guide us in the treatment of cases of obstruction, it is this: that opium be administered by the mouth, and aperients only by the rectum. Every rule may have an exception; but experience has taught us, that whenever this rule has been departed from, subsequent occasion for regret has arisen. In the early and more acute symptoms, small and repeated doses of calomel may be combined with opium if peritonitis be suspected, or is already well marked. Leeches and hot fomentations may be applied to the abdomen, especially if great pain and acute tenderness exist. Enemata should be used frequently and in large quantities, especially if it be suspected that the obstruction is the result of impacted fæces.

The introduction of the long tube may be attended by some difficulty, but if successful secures a most efficient administration of enemata. The use of enemata may occasionally prove injurious. In a case of twist of the sigmoid flexure, the enemata injected in the usual manner were retained, and never returned. Subsequent to death, it was found that a long tube could be inserted beyond the twist into the dilated bowel; but in consequence of a flap-like entrance at the commencement of the latter, the fluid injected into it could not be returned. The enemata used in such cases should be warm water, their mechanical action being of far greater importance than their specific properties.

In the management of every case of supposed intestinal obstruction, every variety of solid food should be rigidly prohibited. Life should be entirely sustained by fluid nourishment.

When situated low down in the sigmoid flexure, or upper portion of the rectum, the obstruction will be more readily detected, as the accumulation in the larger bowel increases. In such conditions it is prudent, if practicable, to overcome the immediate effects of obstruction, by passing a small gum catheter through the stricture, and injecting warm water into the bowel; or by introducing the finger gently and slowly into the gut above, to dilate slightly the contracted part. In the latter attempt much care is necessary. The passage of the finger should not be hurriedly or hastily effected. The stricture in these parts is commonly the result of cancer; the parts are consequently thickened, often ulcerated, and brittle under manipulation. The duration of the disease has allowed it, probably, to implicate the whole structure of the surrounding gut, and has often involved the peritoneum in the diseased mass. As the bowel, from the load above, is pressed down far lower than its natural relations, the peritoneal reflexion in consequence comes

much nearer the external aperture; a sudden dilatation of the diseased bowel, a rapid thrust of the finger through the obstruction, can only be effected at the expense of some laceration of the diseased tissues.

A man was admitted into St. George's Hospital, under the care of Dr. Nairne, with constipation of some days' standing. Treatment having failed to procure any action of the bowels, the author was requested to make an examination of the state of the rectum. This was found pushed down so that the orifice was on a level with the lower edge of the nates. A stricture was readily felt, within a short distance of the anus, pressed down, however, by an immense collection of faecal matter. A small gum catheter was introduced without difficulty, and allowed the passage of some fluid faeces and flatus, with great velocity. The forefinger was subsequently passed very slowly through a rather resistant contraction of the bowel, the result of large deposit around it. The man shortly had great desire to pass a motion, and a copious evacuation of fluid faeces took place; but while on the close-stool, he was seized with excruciating pain, which continued for some time. He died the following morning. The intestines were greatly loaded, especially the lower bowel. In the pelvis, recent effusion of lymph and faeculent extravasation were observed. A small rent in the peritoneum on the anterior face of the rectum, just above the recto-vesical fold, ran through the diseased (cancerous) mass into the cavity of the gut; a rent no doubt made in the wall of the bowel during the dilatation of the stricture by the finger. Through this rent the faeces had passed into the cavity of the peritoneum.

We have now to discuss the conditions under which it is justifiable to operate in obstruction of the intestines, when all other efforts have failed to procure relief.

The operations for the relief of obstruction are of two kinds. In one (Littre's), the abdomen is opened by cutting through the peritoneum. In the other (Amussat's), the intestine is opened in the loin, external to the peritoneum.

The duration of constipation is not *the positive* indication for such interference. Death takes place in three or four days, if perfect strangulation of the bowel has occurred from the pressure of a band of false membrane, or from intestine having slipped through some contracted aperture in the omentum or mesentery. In such a case, constipation is not the most important symptom. It is not *the* symptom, which of itself indicates the absolute necessity of active interference, or the hazard of delay. In common or cancerous stricture of the rectum, constipation is often not complete or continuous, although the accumulation of faeces may be great. Six weeks or two months may elapse without a motion, and without fatal results from such an occurrence. Constipation here again is not alone *the* symptom which warns the Surgeon to act with his knife. In constipation following peritonitis the result of injury, in habitual or other accidental constipation, the bowels may remain locked up for a month, or even two, and yet ultimately yield to treatment or time, and recovery take place. Constipation in the latter instances cannot therefore be taken as *the* signal for the establishment of an extraneous outlet to the contents of the bowel.

But in the more acute instances of strangulation, with vomiting, pain, and distension, complete constipation must be present to justify operative interference. In the more chronic instances of obstruction, no matter how great the distension of the intestines, so long as faecal ejections can be secured in never so small a quantity, the means to encourage them must be persevered in. No immediate operative measures should be sanctioned.

It is but rational to suppose, that in invagination of the intestine, operative interference holds out no prospect of relief, immediate or remote. The pathological conditions already discussed must satisfy the reader that such a conclusion is founded on substantial reasons. The common occurrence of invagination in early infancy; the frequent, often severe, peritoneal mischief which accompanies many cases; and the prospect of slough and separation of the invaginated portion,—are the chief facts which strengthen the above

conclusions. The following results are interesting: In *twenty-four cases* of intussusception, occurring at various periods of life, from two months and a half to fifty years of age, there died without any relief *thirteen cases*; some as early as three days, some as late as forty days, from the commencement of the symptoms. In the other *eleven cases*, the invaginated pieces of intestine sloughed and were passed by stool. Of these *eleven cases*, *two* died soon after the passage of the slough. *Nine cases* entirely recovered. The patients who recovered were ill for periods varying from five to thirty days respectively; their ages varied from six to fifty years.*

The injection of air or water into the rectum has been proposed and adopted in supposed cases of intussusception; nor can we say that such treatment has not been attended with advantage; for in well-authenticated cases with symptoms of invagination, this treatment appears to have done occasional good. The proof, however, is wanting, that actual invagination existed in such cases. This form of treatment cannot be supposed to possess any advantageous influence in the reduction of invagination of any extent or of some duration. The too indiscriminate employment of air, or of water, for the purpose of distending the bowel, with a view to reduce the prolapsus—to push it up, as it were—may act most injuriously; the peritoneum covering the intestine may be ruptured in consequence. But applied with discrimination, the use of warm water enemata alone is a measure which frequently will afford relief, temporary, if not permanent, in many conditions of constipation, and should be always had recourse to; not with an expectation that it will unravel an invaginated piece of gut, but that, if the diagnosis be incorrect, and constipation depend on other and remediable causes, benefit may accrue, and perhaps recovery be insured thereby.

In the treatment of all other forms of obstruction dependent on structural derangement or organic disease, medicines are of no avail. If the obstructing cause be not removed, or if the condition of the intestine be not relieved by some effective measures, the patient will surely die, and in a comparatively short time.

"Internal strangulation," observes Rokitansky, "when diagnosed, most imperatively requires an operative proceeding, for the purpose of disentangling and arranging the intestines, and for the division of the strangulating structures."† Mr. Phillips, after careful study of the subject, arrived at the conclusion "that the interference by surgical operation is justifiable when three or four days have passed without any relief from ordinary means (provided the constipation be complete, and vomiting of fecal matter continue), because it affords a greater chance for the preservation of life than ordinary means."‡

Mr. Curling is of opinion "that the success which has attended the operation of lumbar colotomy, in persons weakened by organic disease and want of nourishment, shows that the operation is not so formidable and dangerous as is commonly supposed."§

The alternative of cutting into the abdomen for the relief of obstruction must always be regarded as a choice of evils. This is the intrinsic worth of the operation. Nothing better can be said of it. On the one hand, a patient is suffering from the effects of internal displacement of intestine, which will surely destroy life in a very few days; or from a disease which will, by causing obstruction, certainly prove fatal in a few weeks, unless the displacement be set right, or the effects of the disease be obviated by an artificial outlet above the stricture.

* These particulars are taken from cases published by Mr. Hinton of Blaina, in an able article on "Intestinal Obstructions," in the *Association Med. Journal*, 1853, p. 451.

† *Path. Anat.* vol. ii. p. 54.

‡ *Med. Chir. Trans.* vol. xxxi. p. 35.

§ *British Med. Journal*, 1863, p. 111.

It becomes manifest, when the anatomy of obstructions is fully considered, that one of two operations must be adopted, if relief is to be attained and life preserved; viz. cutting into the peritoneal sac, and endeavouring to remove the cause of strangulation; or cutting into the colon in either lumbar region without entering the cavity of the peritoneum.

It is next a matter of importance to consider under what conditions either operation should be undertaken; in what manner each should be performed; and what should be the subsequent treatment of patients, subject to such operations.

The operation of opening the abdomen through the peritoneum is requisite for the relief of internal strangulations of the small intestine, or obstructions caused by foreign bodies or calculi, or supposed strictures of the small intestine. That of opening the colon in the lumbar region can only be useful when obstruction occurs in the large bowel.

In internal strangulation dependent on any of the causes already referred to, an opening into the peritoneal sac should enable the Surgeon to ascertain the cause of obstruction; or in many cases to divide the constricting band, or dislodge the intestine from the gripe of a fissure in the omentum.

The operation of opening the peritoneum will prove least successful under the following conditions: 1st, in cases of stricture of any portion of the small intestine; 2d, in cases of obstruction from foreign bodies or calculi lodged in the intestine; 3d, in cases in which peritonitis has set in from too long neglected strangulation.

The last condition alluded to indicates the importance of early interference. The formation of an artificial anus of the small intestine offers the only prospect of prolonging life. In the removal of a foreign body, provided the operation be recovered from, it may reasonably be anticipated that the artificial anus will close. In a case in which a portion of the ileum was strangulated by small intestine coiling round it, the peritoneal cavity was opened, the strictured part was relieved, and the patient recovered.*

The conditions which justify this operation are, a sudden attack of pain, followed by desire to be relieved, but with no action of the bowels, and persistent vomiting; and if little or no tenderness on pressure should exist, constipation must be complete, and must have exceeded a period of twenty-four hours, in company with all the above symptoms. It must be borne in mind that the amount and character of the pain are very important symptoms in these cases. If the strangulating orifice happens to be very small, or the band very tightly applied over the bowel, so that strangulation shall be very complete in the onset of the symptoms, it will be marked by great suffering, irresistible vomiting, great anxiety and restlessness, and complete constipation. Under such circumstances, delay in operation is dangerous. We cannot afford to wait, if we hope to secure ultimate relief; death will occur in three or four days, if some attempt be not made to remove the cause of obstruction, by opening the peritoneum.

In strictures of the rectum, sigmoid flexure, or transverse colon, the operation for relief is confined to either lumbar region, from whence the intestine may be opened, where it is uncovered by peritoneum. The advisability of this operation can generally be fully weighed before it is necessary to perform it; for there is usually less urgency of symptoms in cases which require it than in strictures higher up; and often a period of a week or two may be permitted to elapse, provided the patient be carefully watched, before operation is absolutely requisite.

The conditions which demand it are, long-continued and unyielding constipation, great distension of the abdomen, and commencing irritability of the stomach, or actual vomiting.

The conditions which forbid us to anticipate recovery, and therefore should withhold surgical interference, are, shrunk countenance, feeble and

* *Prov. Med. and Surg. Journal*, June 11, 1851.

quick pulse, cold or clammy skin, and general tenderness of the abdomen, superadded to the symptoms enumerated above.

The operation of opening the peritoneum, for the examination of strangulated or obstructed intestine, and for the formation of an artificial anus in the walls of the abdomen, was first advocated and adopted by M. Littré; in modern times at least, though the abdomen had been opened by Pillore of Rouen in 1776, and an artificial anus formed in the cæcum, for cancerous obstruction of the rectum.* The operation of M. Littré is thus described: "Il faudrait faire une incision au ventre, et recoudre ensemble les deux parties après les avoir rouvertes, ou du moins faire venir la partie supérieure de l'intestine à la plaie du ventre, que l'on ne refermerait jamais, et qui ferait la fonction d'anüs."†

This operation, originally proposed for the relief of imperforate anus, is what to which we can alone have recourse to relieve any form of internal strangulation, or obstruction dependent on mischief *confined to the small intestine*.

It is not desirable to adopt this operation in obstructions *confined to the large intestine*. The operation which insures the opening of the ascending or descending colon, commonly termed the operation of Amussat, is alone to be adopted in these cases.

The operation for opening the peritoneal sac, to explore its contents, requires but little to be said respecting the method of proceeding. The Surgeon having decided upon the operation, should have the patient placed on a conveniently high bed or table. The bladder should be emptied by a catheter. The incision should commence an inch below the navel, and be carried down about four inches, or sufficiently low to allow of the obstruction being thoroughly investigated.

The first incision should extend down to the linea alba, which should be next carefully cut through at one point, that the peritoneum may come into view. A broad director should now be passed under the conjoined aponeurosis, and the latter further divided, so that the peritoneum be fully exposed. A small opening must be carefully made through the latter, sufficient to allow the introduction of the first and second fingers. These being passed into the sac of the peritoneum, will serve the purpose of a director, and upon them a blunt-pointed bistoury can safely be introduced, in order to extend the incision in the peritoneum, either upwards or towards the pubes, as necessity or convenience direct.

When the abdomen is laid open, search must be made, slowly and carefully, for the constricted piece of intestine. The distended bowel may be followed down, if there is difficulty in at once arriving at the point of obstruction, until the cause of mischief is reached. It is impossible here to enumerate all the difficulties that may now be encountered; it must be sufficient to point out that bands of lymph or adhesions should be carefully separated, or divided; or the strangulated intestine withdrawn from any loop or fissure in which it may have become entangled: or should a foreign body or calculus cause the stoppage, it should be removed by opening the intestine, subsequent artificial anus being the necessary result; for the edges of the wound of the bowel must be stitched to the margins of the external wound, and care taken that fæculent matter be not allowed to enter the peritoneal cavity.

Except in the latter instance, the wound of the abdomen should at once be closed; the edges had best be drawn together with silver-wire sutures. The subsequent treatment of such an operation should consist of perfect rest and quiet; warm light applications to the abdomen; and opium administered by the mouth in one or two grain doses every four hours, as long as the

* On artificial anus, *British and Foreign Medical Review*, vol. xviii. p. 452. The author begs to acknowledge the assistance he has received from the perusal of this most able essay.

† *Hist. de l'Acad. des Sciences*, 1710, p. 36.

patient does not sleep. Sleep should not be disturbed to administer a dose due : for sleep alone, in these cases, contra-indicates the repetition of opium. Its internal use should be continued until the patient is quite restored to convalescence, and the motions are natural and regular ; for the continued administration of opium to this period has been found not to hinder a natural and healthy action of the bowels. Its effects are most instrumental towards recovery.

When an obstruction is known to be situated in the rectum, or suspected in the sigmoid flexure, the descending colon must be opened ; when suspected in the transverse or descending colon, the ascending colon, or cæcum, must be cut down upon. The exact seat of stricture may occasionally be ascertained—if in the rectum, by the introduction of a finger or a bougie ; if in the sigmoid flexure, it is often made manifest by swelling, thickening, or hardness of the part. The stricture is less evident externally, when seated in other portions of the colon. It then often becomes mere speculation at which part of the bowel the obstruction is seated.

The chronic nature of the symptoms, the slow accumulation of fæces, point to the large gut as the seat of mischief ; but whether the obstruction lie in the transverse or descending colon, it is generally impossible to decide. Under such circumstances, the only safe course would be to open the ascending colon.

The operation of opening the colon was first advocated by Callisen,* but attempted by him only on the descending colon. M. Amussat modified it by extending it to the ascending colon.

But to M. Amussat is alone due the credit of having revived the operation—an operation not only fallen into disuse, but condemned as dangerous and impracticable by some very modern writers.

The virtue of this operation is, that it enables the Surgeon to expose the intestine and open it, where it is uncovered by peritoneum, and where it lies in front of the quadratus lumborum muscle, and merely separated from that muscle by cellular tissue. The situation of the external incision, on either side, is in the lumbar region, between the last rib above, the crest of the ileum below, a vertical line running from the end of the rib to the crest of the ileum in front, and the edge of the longissimus dorsi behind. The colon in this space is fixed to the abdominal wall by the reflexions of the peritoneum, and lies loosely in contact with the quadratus lumborum. The kidney is situated rather above the seat of the incision. There is no meso-colon here ; and if the colon be much distended, the cellular space between the folds of peritoneum will be very conspicuous. It is at this part that the intestine should be opened.

Callisen advocated a vertical incision for this purpose in the loin ; Amussat has judiciously recommended a transverse one. The advantages are thus fairly stated : 1st, that it makes the operation easier and more certain, and avoids the danger of dividing the lumbar vessels and nerves ; 2d, that it facilitates finding and opening the intestine without wounding the peritoneum ; and 3d, it enables us to establish the artificial anus more anteriorly.†

The incision should commence in front of the longissimus dorsi, and be carried forwards to the extent of about six inches. The integuments having been divided, the muscles are to be carefully cut through until the intestine is exposed. This is not a difficult or troublesome proceeding. The intestine, especially if loaded, presents its muscular surface in the bottom of the wound uncovered by peritoneum. The bowel should be at once hooked up by a curved needle—two or more points should then be secured by threads to the margins of the wound, and the gut opened. Usually a great gush of fluid fæculent matter takes place ; ample provision should therefore be made to secure it as it flows out, to prevent the bed becoming greatly soiled, which

* *Systema Chir. Hodiern.* t. xi. p. 842, Hafniae, 1817.

† Amussat's *First Memoir*, p. 241.

could be the case in a few seconds, if suitable basins be not at hand to apply to the edge of the wound.

The intestine should be allowed gradually to empty itself, and the patient subsequently must be steadily watched and well supported. Usually the relief is at once considerable, but faintness is apt to come on; and if peritonitis has set in before the operation, the patient soon sinks.

The usual method of controlling the constant discharge of fæces through the wound, is by the use of an ivory ball attached to a small shield, over which a soft thick piece of india-rubber should be fastened externally; and this maintained in position over the wound by a bandage. The ball is to be so adapted as exactly to fit the wound in the bowel. The after treatment must be guided by circumstances; but opium and support are the chief constitutional requirements, and great cleanliness the most important local consideration.

Though we have advocated this operation as a measure of relief, one that has often prolonged life many months, and one frequently of late adopted in this country, we should not do justice to our subject were we to omit to refer to the opinion of one of the most distinguished recent authors on practical and general surgery, who states, "that he has performed this operation but once, and that nothing could ever induce him to attempt it again; that the operation is founded upon misdirected sympathy, and that it ought to be discarded, as among the obsolete devices of surgery."*

The Operation of Tapping,—Paracentesis Abdominis.

When the abdomen becomes inconveniently distended with fluid, contained either in the peritoneal sac or in an ovarian cyst, it is desirable to relieve the patient by tapping the cavity in which the fluid is lodged.

Previous to the operation, the patient may be placed upright on the edge of a chair, or recumbent on the side of a bed. A broad towel, warmed, should be passed round and above the umbilicus, and a second one below; the ends of these towels being held behind the patient, to be tightened as the fluid escapes from the abdominal cavity, in order that a certain amount of support be afforded to the viscera when the whole of the fluid is abstracted. Previous to the introduction of the trochar, it should be ascertained that the bladder is not distended with urine. A small incision should first be made through the skin, about two or three inches below the umbilicus, just sufficient to allow of the passage of the cutting surfaces of the trochar without injury to the skin. This proceeding allows the trochar to be passed readily into the abdomen, and is less painful than if the trochar be thrust through the integument. The trochar should be pushed nearly up to the tilt of the canula, and the stilette then withdrawn, care being taken that the canula does not slip out after it. The fluid will now escape freely if serous in character, and the cavity will soon be emptied.

If the patient become faint during the flow of the fluid, a finger may be applied to the orifice of the canula to arrest the escape, while some stimulant is administered, and until faintness passes off. The common trochar, with short canula, is the simplest implement to use in this operation, and as efficacious as any; but of late a tube of india rubber has been adapted to the canula, so that the fluid may be carried to a basin at the foot of the chair or bed which supports the patient. The choice of the instrument is a matter of fancy; the original and most simple trochar is as efficacious and as convenient as the most modern complicated one.

It sometimes happens, that after a certain quantity of fluid has escaped, the flow suddenly ceases, while there is still much remaining in the cavity; this is occasioned, probably, by intestine or some other substance coming in contact with the inner extremity of the canula; the obstruction may be remedied by either moving the position of the canula, or introducing the

* Gross, *Surgery*, vol. ii. p. 685.

blunt-pointed but perforated tube, with which each case of trochars should always be provided.

The large accumulation of fluid in the cavity of the peritoneum, or in an ovarian cyst, usually pushes the anterior abdominal wall so far forwards that a considerable interval intervenes between it and the surface of the intestines; so that when the trochar is introduced, there is little risk of wounding the bowels. This is, however, an accident which occasionally happens, and therefore it behoves the Surgeon to make a very careful examination of the surface of the abdomen, before proceeding to operate; if any tympanitic resonance be detected near the umbilicus, or below it, the operation had better be postponed or avoided. Mr. Gay exhibited, at the Pathological Society, a specimen of a portion of the jejunum, which had been punctured in the operation of tapping, in a case of ascites; but the patient survived the accident, and died three months afterwards, apparently from the disease which produced the ascites.* The wound caused by the trochar should be dressed with lint and plaster, and a bandage applied over it, round the belly. In a few days the parts have usually healed.

GEORGE POLLOCK.

* *Pathological Trans.* vol. ii. p. 203.

DISEASES OF THE RECTUM.

IN the following essay on Diseases of the Rectum I have treated the subjects in the order of their frequency and importance: Hæmorrhoids; Prolapsus; Fistula; Ulcer; Stricture; Cancer; Polypus; Pruritus; and Neuralgia. Nothing has been said in reference to malformations of the anus and rectum, as this subject is considered in the essay on the SURGERY OF CHILDHOOD.

HÆMORRHOIDS.

It has been the custom of surgical writers, when describing hæmorrhoids, to divide them into two distinct kinds, namely external and internal. This is a classification from which it is perhaps not well to deviate; for although many instances are seen where it is impossible to say whether the disease be internal or external,—and, pathologically speaking, hæmorrhoidal tumours, wherever situated, are essentially constituted of the same morbid elements, viz. an enlargement of the vessels of the rectum, and an infiltration of their connecting tissues,—still circumstances which exist, or which occur, in connexion with this disorder so modify the pathological features, that in numerous instances there is a wide and well-marked distinction between those hæmorrhoidal tumours seated outside, and those involving the gut within the sphincter.

I shall therefore adhere to the classification, and first speak of

External hæmorrhoids, which are situated at the verge of the anus outside the sphincter, and consist of one or more tumours, composed at their first formation of dilated vessels. As the disease increases, from various irritating causes the sensitive skin around the anus becomes thickened, the cellular tissue is indurated and infiltrated, and the veins are expanded. By degrees the swelling becomes larger and harder, and does not give much annoyance when the parts are in a quiescent state; if, however, they become attacked with inflammation, the tumour increases much in size, the blood in the vein becomes coagulated, and not unfrequently the vessel gives way, allowing the coagulated blood to escape into the surrounding cellular tissue, where it will form a distinct sheath for itself. In the course of time the inflammatory

action subsides, the blood becomes absorbed, and the tumour diminished in size, or wholly disappears. If, however, the same irritating causes recur, and no effectual treatment be adopted, the tumour again increases, the skin becomes thickened, and the cellular tissue more extensively infiltrated; and in this way distinct and permanent tumours are formed around the anus, which sometimes reach a large size, consisting mainly of thickened integument and cellular tissue enclosing veins which are at times capable of distension and repletion. In their quiet state these tumours are distinctly external; but when increased in size they may encroach upon the cavity of the rectum and be covered with mucous membrane, and thus be partly internal. Coexistent with this state there is not unfrequently a very œdematous condition of the cellular tissue and mucous membrane at the verge of the anus.

With regard to the actual structure of these hæmorrhoidal tumours, it will be found on examination that they are composed of thickened integument, infiltrated cellular tissue, and in most cases of one or more dilated veins; if the part is at perfect rest, and has not been lately inflamed, there may be distinguished nothing beyond infiltrated tissue and thickened skin; but on cutting into an external pile which has been somewhat irritated, or is increasing in size, there will be found either a vein considerably dilated and containing semi-coagulated blood, or the blood will have escaped from the vessel, and have become either extravasated into the surrounding cellular tissue, or have formed for itself distinct cellular sheaths. This coagulation of the blood is the reason why an incision into an external hæmorrhoidal tumour, after having become inflamed and swollen, is scarcely ever attended with bleeding, and it is one of the main pathological features in this form of tumour, and far different from what obtains in instances of the internal affection.

These external hæmorrhoids vary much in size, the swellings being sometimes not larger than peas, while at other times they are the size of a walnut. Their presence is accompanied with unpleasant symptoms: as irritation; pain when at the closet; and a sense of bearing down, even when they are in a quiescent state: but the main source of suffering is their disposition to become suddenly enlarged and inflamed; which occurrence will arise from allowing the bowels to become constipated, from the straining attendant upon a stricture of the urethra, from excess in food and drink, or from exposure to damp and cold. Under these circumstances, the tumour, which has been hitherto small and flaccid, becomes much swollen, distended, and livid in colour. From the peculiarly sensitive character of the skin at the anus, this distension is accompanied with the most exquisite pain; and it is remarkable to witness the complete prostration with which the most powerful man is overcome when suffering from acute inflammation of external piles, and especially when the symptoms have been allowed to go on for some days without the proper means of relief being afforded, either from obstinacy on the part of the patient, or from insufficient pathological knowledge on the part of the medical attendant.

With regard to the causes which produce this form of hæmorrhoids; there is every reason to believe that the same circumstances which tend to the production of external, induce the internal affection as well; and therefore this description will apply to both. It appears that there is in some persons an hereditary disposition to hæmorrhoidal affections; and we shall every now and then see father and son, or mother and daughter, suffering one after the other in the same way. Possibly, however, this may be owing

to similarity in habits, certain of which undoubtedly much more than others induce these affections. Thus, those who have to sit continually at the desk and take little walking exercise are very liable to them; those too who have to stand long in certain positions, as dentists and hairdressers, are remarkably prone to hæmorrhoids. The great source of hæmorrhoidal affections, however, is any thing which prevents the healthy return of the blood from the vessels of the rectum. And thus it is that congestion of the liver, or other obstructive disease of the same viscus, is frequently associated with these affections. A constipated state of the bowels, both from the mechanical effect produced upon the vessels, and from the straining efforts necessary, is found to be the cause in a vast number of cases; the pressure also of the pregnant womb, and of ovarian tumours, produces hæmorrhoids. In other cases, the irritation caused by the frequent taking of aperient medicines is reasonably considered to be productive of the first symptoms of the disease. Violent horse-exercise, indulgence in the use of highly-seasoned dishes and other indigestible food and strong wines, together with immoderate sexual intercourse, which determines the blood more freely to the pelvic region, are each fertile sources of hæmorrhoidal affections. And it is highly necessary, before any treatment is commenced, to inquire carefully into the peculiar habits of the patient.

The treatment which should be adopted for the removal of this affection must be conducted upon the ordinary principles of Surgery. In the more simple cases, little beyond a strict attention to ablution, to the regular action of the bowels, and to the avoidance of those causes which are known to produce the affection, will be necessary. If the bowels are inactive, a draught of cold water before breakfast, or the use of brown bread, with a moderate amount of walking exercise, will in many cases beget a healthy tone in the intestinal canal; if, however, aperient medicines are needed, they should be of the mildest description. The compound rhubarb-pill in doses of five grains, taken occasionally before dinner or before going to bed, is a simple and unirritating aperient. A teaspoonful of the confection of senna is also a useful and efficient aperient. If there be much irritation about the anus, an occasional dose of calomel should be taken, either before or in conjunction with these medicines. At the same time that great care is taken to provide a healthy action of the bowels, local remedies should be made use of. The ordinary lead-lotion, or one made of one or two grains of sulphate of zinc to an ounce of water, should be applied to the parts morning or night; or if a more powerful astringent application is required, the patient should use the compound gall ointment, which is an admirable agent. By these means, and by careful attention to diet, most of the ordinary cases of external piles presented to our notice may be cured, or so relieved that they will hardly excite attention.

If, however, one or more of these tumours become enlarged and inflamed, a much more energetic treatment is required; for there is in such cases very great suffering both local and general. If there is much swelling, and the parts are exquisitely sensitive, the patient must be confined to bed, leeches should be applied to the part, and the bleeding should be encouraged by warm fomentations; and subsequently poultices made either of warm bran or of bread, into which half a drachm of laudanum is dropped, should be applied, and changed from time to time. Opium should be given internally; and as soon as relief from pain has been procured, the bowels should be thoroughly cleared by a saline purgative. The subsequent employment of a lotion composed of liquor plumbi diacet. dil., liquor ammoniæ acetatis, and spirits of wine,—one ounce of each of the latter to six ounces of the former,—will cause a shrinking and collapse of the swelling.

Not unfrequently, however, the Surgeon is called to a case where most or all of these measures have been tried, and yet the patient is suffering acutely; and on examination it will be found that on one side of the anus there is a tumour of a circumscribed form, of a blue colour, and in a state of great distension. In such an instance, the suffering is produced by the accu-

mulation and coagulation of the blood; and the proper treatment is to puncture the swelling freely with a lancet: there is an escape of coagulated or semi-fluid blood, with almost immediate relief to the painful symptoms. The subsequent application of cold water, or the lotion above mentioned, to the parts freely, will cause an almost entire removal of the disease. If, however, there is much loose and thickened skin over the site of the swelling, it should be removed with sharp scissors, after the part has been punctured.

After repeated attacks of this nature, the anus becomes surrounded with distinct tumours, more or less pendulous, and liable to become swollen and inflamed; for this state of things a surgical operation is required. It is, however, a simple one, and consists in the removal of these excrescences by sharp curved scissors. As the patient kneels upon a chair, or lies upon his side, the Surgeon lays hold of each tumour with a hooked forceps, and excises it, with the scissors placed flat upon the skin. Chloroform is rarely necessary; but if the patient is exceedingly timid, the parts may be benumbed with ice and salt, and thus much pain may be escaped. There is generally very little bleeding, especially if great care is taken not to snip any of the mucous membrane.

Simple as this operation is, it may in unsurgical hands be so mismanaged as to bring about serious results. If too much of the lax skin around the anus be taken away at the same time that the tumours are excised, the parts in healing will cicatrise, so that severe contraction of the anus may follow, and the patient be placed in a most miserable plight.

The same effect is likely to be produced, if the mucous membrane at the verge of the anus is interfered with to any great extent: therefore, unless there is an absolute necessity for the step, this membrane should not be cut, and only the external hæmorrhoids, with portions of the redundant integument, should be excised.

Internal hæmorrhoids are more frequent, or at all events are more often presented to the notice of the Surgeon, because they are productive of much more distress, and more serious consequences are liable to result from them than from the affection situated externally: and here it will be as well to mention the symptoms which are produced by them, and which are local and general.

The first local symptom which attracts the notice of a patient suffering from internal piles is, in many cases, a more or less profuse attack of hæmorrhage, which may not recur for some weeks or month, but which may persist; more or less weight and uneasiness are felt at the seat; and in course of time there will be considerable pain when the bowels are being evacuated. As the swelling or swellings increase in size, the evacuation of the contents of the rectum will be more difficult and more painful; straining efforts are necessary; hence the hæmorrhoidal tumours become protruded on each visit to the closet. At the earlier periods of the disease they may be with facility returned; but as time wears on, the pain attending defæcation becomes more severe, and the process of returning the piles becomes more difficult. Not only, however, do they protrude at these times; but if the patient neglects advice, the tumours come down below the sphincter whenever he takes

walking exercise; the constriction caused by the muscle produces congestion in the piles and extreme pain, which is only relieved by their reduction or by a spontaneous flow of blood, which, however, occurs at most inopportune periods. In addition to these symptoms, there is pain and uneasiness felt in the loins and down the thighs, more especially in females, who very often suffer most acutely, and not unfrequently have their sufferings referred to that prolific storehouse of morbid phenomena, the womb. There is, moreover, a considerable discharge of mucus, or muco-purulent fluid, from the anus; the bladder is rendered at times very irritable, and retention of urine not unfrequently takes place.

Patients who suffer from internal hæmorrhoids are liable to get them inflamed from some exciting cause, such as an excess at the table, or great irritation of the bowels, and then the symptoms are extremely severe; the tumours protrude beyond the anus, and become constricted by the sphincter. Violent pains are experienced in the pelvic region, and there is a high state of constitutional disturbance, denoted by flushed face, furred tongue, rapid and wiry pulse, and extreme restlessness. If these symptoms are not relieved either by the accidental induction of bleeding, or by surgical assistance, the congestion and inflammation increase, and to such an extent, that mortification of the hæmorrhoidal masses ensues, and thus is produced a natural cure; but, on the other hand, it is not desirable to encourage this rude attempt at cure, for death may occur from the violent action set up. Dr. Bushe mentions having seen such a case occur.

When internal hæmorrhoids have existed for a length of time, the general health becomes much influenced; the patient complains of indigestion, flatulence, and inability to follow his ordinary occupation or amusement; moreover, if, as is frequently the case, the disease be attended with periodical bleedings, the face becomes blanched, the pulse weak and rapid, and other well-known symptoms of loss of blood ensue. This is the most serious condition connected with hæmorrhoids of long standing, and hence the reason why it is most important to adopt the proper treatment at an early period of these affections.

Internal hæmorrhoids present various appearances. On making an examination of a patient who suffers from the milder form of the affection, the veins of the lower extremity of the rectum just within the anus will be found enlarged and distended, forming small fusiform tumours of a deep-blue colour, covered by a somewhat thickened mucous membrane. In other instances, and especially where the patient complains of bleeding and sense of weight, with scarcely any protrusion, the inferior extremity of the rectum, for an inch or more, will be found highly congested and vascular, the mucous membrane having here

and there distinct patches of morbid vascularity, from which, through a speculum, which it is necessary to use in such cases, blood of an arterial colour will be seen to issue. This is the condition which the late Dr. Houston, of Dublin, likened to the diseased lining membrane of the palpebræ in cases of chronic conjunctivitis. In the majority of instances, however, of internal hæmorrhoids, one or more distinct tumours of a rounded or oblong form will be seen to fill up, as it were, the orifice of the anus. In some cases their character and size can be ascertained by an ordinary inspection; but it is always best, in order to arrive at a proper diagnosis, to throw up an injection of warm water, and allow it to be discharged before the examination is made. By this means the tumours are brought fairly down. There are frequently two or three distinct tumours, varying from the size of a cherry to that of a walnut. In one case, the diseased part presents a bright-red appearance, easily bleeds when touched, is sessile and not very raised; in another case, the tumour is large, prominent, of a deep-blue or reddish-brown colour, having a large broad base, or attached by a narrower peduncle, and does not bleed. In these cases the vessels appear to be largely dilated, the mucous membrane covering them being shining and tense, or thick, granular, and slightly ulcerated. Besides these appearances, portions of the mucous membrane, highly vascular and thickened, may be prolapsed at one or more points, as a consequence of the mechanical weight of the internal tumours. In by far the majority of cases of long-standing piles, the integument surrounding the anus is in an unhealthy condition, being much thickened and now and then forming a distinct ring or long pendulous flaps.

There is one point of importance connected with the seat of internal hæmorrhoids which should not be overlooked, but which, as far as I am aware, has not been mentioned by any writer on this subject. The circumstance I refer to is this, that occasionally instances are met with where the hæmorrhoidal tumours are placed, as it were, in separate rows, so that two or three distinct masses exist near the anus; and about half an inch or more above, other tumours of a similar nature are disposed just in the same way. There are one or two specimens indicating this in the Museum of the Royal College of Surgeons. This is a condition of practical importance; for it shows how necessary it is to make a most thorough examination of a person suffering from internal piles. Cases every now and then occur where the ligature has been applied to one or more internal tumours presenting themselves at the anus; and as the operator is thinking his proceedings are satisfactorily terminated, the patient makes some violent straining effort, and another tumour, or series of tumours, which have escaped notice hitherto, are forced into view. These are formed higher up in the bowel, and do not generally protrude; but if a satisfactory cure is expected, they must not be left alone.

As regards the structure of internal hæmorrhoids,—when first forming, they are composed in many instances simply of dilated veins, in others of dilated veins and arteries too. As the diseased condition increases, the cellular tissue in connexion with the vessels becomes thickened and infiltrated. In a more or less circumscribed space, the mucous membrane also becomes thickened, and is bulged out by the increase in size of the vessels, and thus distinct tumours are formed. The surface of the mucous membrane becomes also exceedingly vascular. On making a section of the lower part of the rectum in some cases of old-standing piles, the veins will be found to be greatly dilated, sometimes partially and irregularly, so that there will be the appearance of distinct cysts; in other instances, the dilated vessels will be found to be filled with coagulated blood and fibrin. In those cases where the hæmorrhoids are of a very bright-red colour and sessile, not unlike a strawberry in appearance, and easily bleeding, the structure consists mainly of a series of small arterial ramifications; but where the tumours are of a darker colour, and like a mulberry, they are composed of veins to a large extent, although no doubt the arteries enter as well into their formation; for when the mucous covering is pricked or incised, the blood which flows is of an arterial hue. In those cases of long standing, where the tumour has become very large, and has been submitted to great irritation, a section will reveal scarcely any thing beyond a mass of highly-

condensed and thickened cellular tissue, with some vessels penetrating the base of the tumour.

The treatment of internal hæmorrhoids requires more consideration than that which is adopted for the disease when situated externally. In the cases where the piles have not existed long, are not large, and give only temporary annoyance, much may be done by the patient paying simple attention to his habits, and avoiding those exciting causes which engender the disease. If it is ascertained that a sedentary life has produced the affection, by determining the blood to the rectum, the patient should take as much walking exercise as possible; if the bowels are sluggish, their action should be encouraged by the compound rhubarb-pill, or by a teaspoonful of the confection of senna; and a quarter or half a pint of cold water, or of infusion of quassia, should be thrown up the rectum daily. Dietetic rules must be strictly attended to; for many patients, especially those who are robust and whose circulation is sluggish, will tell us that they feel much more annoyance from piles after they have been dining-out, or have taken larger quantities of wine than usual. Hence the necessity of those who suffer from internal hæmorrhoids to abstain as much as possible from the pleasures of the table. Women in an advanced state of pregnancy suffering from the irritation of piles should be very careful about the condition of their bowels, and should keep the horizontal posture as much as possible.

When internal hæmorrhoids increase to such an extent as to protrude at the closet, and produce considerable pain and bleeding, greater precautions and more decided treatment are needful. The bowels should never be allowed to become costive, so as to necessitate straining efforts; the protruded parts should be carefully sponged with cold water, or with a strong infusion of quassia or of decoction of oak-bark and alum in the proportion of half a drachm of the salt to twelve ounces of the decoction, and should be carefully returned by the patient; or, instead of these lotions, the gall-ointment may be smeared over the piles with great benefit. The bleeding, which is often very annoying, may be checked by an injection of sulphate of iron and water, in the proportion of one to two grains of the former to an ounce of the latter; or if necessary, a lotion of tannin, in the proportion of eight grains to an ounce, may be used; but it must be borne in mind that a moderate amount of bleeding in persons who live high, and whose vascular system is excited, is beneficial rather than otherwise, and should not be interfered with; the popular notion as to bleeding from piles being salutary is by no means incorrect, when applied to certain cases. When, however, the hæmorrhage arises from some peculiar pathological change in the tumour, such as ulceration or excessive vascularity of the mucous membrane, and when it becomes continuous and goes on to such an extent as to interfere with the patient's health, producing a pallid face, a weak pulse, and irritable heart, it should be put a stop to.

A very common internal remedy for piles is the confection of black pepper, in the dose of a drachm twice a day; it may be given by itself, or, as I often use it, mixed with an equal part of confection of senna. It is difficult to say how the remedy acts; it certainly does good not only in this affection, but it is highly serviceable in other affections of the rectum, and especially in those cases where the wounds become sluggish in healing after the operations for fistula, or for fissure of the anus.

From the close connexion between the neck of the bladder and the rectum, it follows that the affections of the former viscus, together with those of the prostate gland or urethra, will influence the rectum much; and thus, in middle-aged or elderly persons, special inquiry should be directed to these parts; for not unfrequently hæmorrhoids and prolapse of the rectum will be found to be much aggravated, if not caused, by the violent straining efforts made in the difficult attempts to pass water. If stricture exists, the urethra must be dilated before there can be any hope of curing the piles; and even if there be not any stricture, and yet there be a loss of the contractile power of the bladder from debility or old age, this viscus should be artificially emptied by the catheter.

When internal piles become inflamed and protruded beyond the sphincter,

the patient will suffer much both locally and constitutionally. He must be confined to bed, and the piles, if possible, should be carefully returned by the Surgeon; but if this be a work of great difficulty from swelling and congestion, leeches should be applied, and subsequently warm fomentations and poultices. Ice locally applied in a bladder is a valuable agent to diminish inflammation and pain. Opium should also be given in full doses. Any operation which may be considered advisable should not be put in force whilst the hæmorrhoids are in a state of active inflammation. Sometimes, as I have before stated, the constriction of the sphincter produces sloughing, and a spontaneous cure takes place; if this is occurring, the process must be expedited by the liberal use of warm bathing and poulticing, and pain must be conquered by the administration of opium.

By the adoption and right application of these remedial measures, a large proportion of cases of internal hæmorrhoids may be cured, or relieved to so great a degree as to prevent annoyance; but many of the cases which come under the notice of the Surgeon have existed so long, have reached such a size, and are productive of such troublesome and even serious symptoms, that some active surgical interference is required, in order to bring about a cure or render efficient relief. Originally the usual remedy in aggravated cases was the excision of the diseased part, and it was a remedy accompanied with little pain or difficulty; but the danger of hæmorrhage proved to be so great, that after the sacrifice of several lives the practice was abandoned. It is necessary, even when the excision of external piles is being performed, to take care that the mucous membrane is not too freely clipped, otherwise dangerous bleeding may result. I saw a gentleman nearly lose his life from the inclusion of a portion of mucous membrane in the blades of the scissors during an operation for external hæmorrhoids: the operation was done at 2 P.M.; and at 6 I was sent for, and found that he had been bleeding profusely.

The removal of internal hæmorrhoids by the ligature is the method which has been commonly followed of late years; and it is necessary to devote more consideration to this part of the subject, as this treatment is most generally adopted by the very best Surgeons of the day. The manner in which the ligature acts is by the strangulation of the vessels which supply and form the tumour; the result is, sloughing of the tied part, and its subsequent removal in a few days. A sore is left on the separation of the thread, which, in healing, cicatrises, contracts, and braces up the neighbouring tissues; so that, in addition to the bodily removal of the tumours, the tendency to their reproduction, or to any protrusion of the mucous membrane, is diminished by the result of this process.

It is undeniable that the ligature is an admirable remedy, and that it is calculated, when properly applied, to bring about a cure in the worst forms of internal hæmorrhoids; but its employment is open to some objections, which it is right to mention.

In the first place, it is necessary that those who undergo the operation by the ligature should be confined to their bed for some days. In the next place, the process of applying the ligature is attended sometimes with considerable suffering. In some conditions of the constitution a low inflammation of an erysipelatous character may ensue, and spread along the intestinal tract, producing the most severe and even serious symptoms. Pyæmia also has occasionally ensued after this operation, and has destroyed life. Sir Benjamin Brodie, Sir Astley Cooper, Mr. Henry Lee, and others, have mentioned fatal cases from this cause. Tetanus has also carried off patients who have undergone this operation.

I dwell more particularly upon these untoward events, because it is rather the fashion to look upon the operation by ligature as a perfectly safe proceeding. Mr. Syme has even gone so far as to state his opinion that "it may be used without the slightest risk of any serious inconvenience."* Now I do not

* *On Diseases of the Rectum*, 3d edition, p. 8.

hesitate to say, that no Surgeon who is acquainted with the literature of this subject is justified in making a statement so strong as this, even though his own experience of the operation may have been of the most favourable kind.

I hope I shall not be looked upon, from the previous remarks, as an opponent of the ligature; on the contrary, I believe that this proceeding, when rightly applied, and followed by proper treatment, is an admirable remedy, and generally productive of a perfect cure; and as regards danger to life, although there is some risk, with which the patient should be made acquainted, it is undoubtedly small; and this may be lessened by taking care not to operate on persons who are much broken down in health, or suffering from any organic diseases of the intestines, liver, or kidneys.

The ligature is indicated in those cases where the hæmorrhoidal tumours are large, well-defined, and prominent, and where they present a dark-blue appearance, as though they consisted mainly of venous ramifications; also in those instances of internal hæmorrhoids where the tumours are of a bright-red colour, and easily bleed, but their dependent portions, from continued prolapse and irritation, and from existing many years, have become very much thickened and indurated. It is also proper in those cases where there is a considerable amount of prolapsus attending upon the original affection; and if an alarming extent of hæmorrhage has been the most prominent symptom, and this bleeding proceeds from a distinct tumour, the ligature should undoubtedly be applied.

This proceeding is also well adapted for those cases where patients are exceedingly sensitive and nervous, and will not allow more than one operation to be performed. In a recent case in which I applied the ligature, the disease might have been destroyed by nitric acid; but the patient was very timid, and I thought it prudent to adopt a measure which would only be required once.

The operation is performed in the following manner. The patient, who has previously had an enema of warm water, so as thoroughly to bring down the hæmorrhoidal tumours, either kneels on an arm-chair, or lies on his side upon a bed or sofa. An assistant separates the buttocks, whereupon the Surgeon lays hold, with a long pair of forceps or vulsellum, of the tumour which is to be operated on. The assistant makes traction with the instrument, so as to expose and isolate the tumour as much as possible. The operator then, by means of a well-curved needle set in a strong handle, passes a double thread of strong silk or twine through the base of the mass; and having cut the thread and removed the needle, ties each half of the tumour as tightly as possible. The ends of the ligatures are cut off close to the knot, the protruded parts are returned within the bowel, and the operation is finished. It is better to notch the circumference of the tumour at the point where the ligature will fall before it is tied, as the separation will take place earlier: for this hint I am indebted to Mr. Curling. If there are two or three distinct hæmorrhoidal tumours, each of them must be operated upon in the manner I have described.

If there is much loose integument about the anus, the redundancy should be removed with the scissors. Too much ought not to be taken away, as inconvenient contraction might take place; but the Surgeon who understands his business will not be likely to fall into an error of this kind. If the loose flaps of thickened integument which are so frequently seen in connexion with hæmorrhoids are not taken away by the scissors, there is a probability that the cure will not be perfect. Several cases have lately been under my care where the ligature had been applied by various Surgeons, and where the disease had returned. In some of these cases the external folds of integument had not been removed, and I cannot help believing that this neglect had been the cause of the failure of the operations.

The proceedings above detailed are finished in a few minutes. If the patient is courageous and determined, I would rather operate without giving him chloroform; but if he is highly sensitive and timid, it would be better that he should inhale it, as the pain in such instances may be very severe.

The patient must keep his bed for some days after the operation. A full dose of opium should be given the first night, so that pain may be prevented and the

bowels be confined; if there be much pain about the seat of operation, ice applied in a bladder continuously will give great relief. Retention of urine is apt to follow this operation, and when present must be relieved by the catheter. It is desirable to keep the bowels quiet for three or four days, if possible, and then to obtain an evacuation by a dose of castor-oil. Very likely the ligatures will separate on the first action of the bowels; at all events they generally come away on the fifth or sixth day. Some pain is felt in the part for a few days afterwards, and during this time the patient should keep quiet: convalescence may be expected in a fortnight from the time of the operation.

Excellent as a means of cure though the ligature may be for the more severe cases of internal hæmorrhoids, it is not necessary in many instances which nevertheless require active surgical interference; and if we possess any means by which the disease may be cured or remedied without the confinement, and that certain amount of risk which is associated with the practice of the ligature, we are bound to consider in what cases it may be employed.

Nitric acid was strongly recommended by the late Dr. Houston of Dublin as a means of getting rid of some forms of internal hæmorrhoids; and it is somewhat curious that, although his paper was published in the *Dublin Quarterly Journal* more than fifteen years since, and Mr. Fergusson, in his *Practical Surgery*, soon afterwards drew especial attention to the subject, the use of the agent was comparatively unknown, or at all events has not had that attention paid to it which it deserves. I have been in the habit of using the strong nitric acid in certain cases of hæmorrhoidal affections for a period of ten years. Mr. Henry Lee has incorporated with his *Surgical and Pathological Essays* an admirable paper on this subject, and has spoken highly of the plan of treatment which I am now about to consider.

I have stated, whilst describing the nature of internal hæmorrhoidal diseases, that the condition in which they are found varies. I have endeavoured to point out those cases to which the operation of the ligature is applicable, and have stated that this practice is justifiable in those instances where the tumours are large, mainly composed of tissue in which the veins predominate, and have become indurated.

There are, however, other instances where the hæmorrhoidal tumours are small or moderate in size, and where they are evidently composed of morbid texture in which the small arteries rather than the veins are interested, as shown by their bright florid aspect, and by their tendency to pour out arterial blood whenever the patient is at the closet, or when the tumours are handled. These tumours are sessile, and generally not very prominent. They produce exceeding annoyance, and indeed prove most destructive to the health, as they generally yield a great deal of blood. Now, in such cases, the ligature will undoubtedly be as effective as in the other instances before described; but this proceeding is not necessary, as the local use of the nitric acid is so eminently suited to them. The relief which one single application of the acid gives in these cases is remarkable; and an excellent cure may be effected if the whole of the diseased texture be subjected to its action.

About this particular kind of case there is no doubt in the mind of any Surgeon who has seen the nitric acid applied in a proper manner. There is, however, a mixed class of cases where the remedy is an uncertain one, but in which nevertheless the Surgeon is justified in trying it, and where I sometimes have succeeded when I little expected it. I refer to those cases where there is a hæmorrhoidal mass, consisting perhaps of one tumour mainly composed of venous ramifications and of a bluish colour, with one or more presenting the characters of the florid sessile pile; or one portion of the tumour or tumours may present the dark-blue appearance and thickened membrane, and another portion of it may be brightly vascular, and have its mucous covering granular or slightly ulcerated. In this kind of mixed case I do not hesitate to try the acid, if the patient is particularly desirous; but I make a point of stating that it is impossible to depend upon any curative action in such a case, although in some instances the remedy has acted most efficiently.

To apply the agent in those cases where the tumours are large and indurated,

and have a deep-blue colour, would be perfectly useless, and only bring discredit upon the nitric acid as a means of cure in other kinds of hæmorrhoidal diseases.

It is, however, in that class of cases not unfrequently met with, where there is not so much any decided hæmorrhoidal tumour, but where there is a congested and relaxed condition of the mucous membrane of the rectum, attended with bleeding to a greater or less extent, that the nitric acid acts so beneficially. Dr. Houston has compared this condition of the rectum not inaptly to that of the thickened conjunctiva after long-continued ophthalmia. The application of the acid to the diseased points from which the bleeding proceeds will soon remedy all the bad symptoms.

The following is the mode of applying nitric acid: The bowels having been well evacuated some hours previously, the diseased portion to which the application is going to be made should be well exposed by making the patient sit over hot water for some few minutes; or if this is not sufficient, an enema of water should be thrown up the rectum, and the hæmorrhoidal disease will be brought well into view. The part to which the acid is to be applied should then be carefully wiped with a piece of lint. The Surgeon then dips the extremity of a small flat piece of wood into the nitric acid, and touches the diseased surface carefully with it. The part touched, and the neighbouring mucous membrane, is well smeared with oil, and the whole is returned within the orifice.

I can truly say that it has never occurred to me to witness any thing like a fatal, or even a dangerous result, after having had a large experience of this remedy. In one case, of a patient who was most anxious to be cured by one operation, I applied the nitric acid much more freely than usual, and produced great suffering for two or three days, with the effect, however, of making a good cure. In another instance, I heard, but was not a witness of the fact, that copious bleeding followed the use of the acid. In a third instance, which occurred very lately, a young lady was treated with the nitric acid for a florid pile. Severe and unaccountable suffering was produced for many days. On making a careful examination at the end of this period, I discovered a small ulcer situated at the posterior verge of the anus, and exquisitely painful; suitable remedies relieved the pain in a few hours. On inquiring more minutely into the particulars of this case, I have reasons for believing that this ulcer existed before I applied the acid, and that some of the caustic came into contact with the sore and produced the severe suffering.

I have now and then met with cases where retention of urine and pretty smart bleeding have occurred after the free use of the nitric acid, but never sufficient to cause me anxiety; and they are symptoms which are easily met.

It is not necessary to confine patients to their bed after the acid has been applied; and this is one of the reasons why the remedy is so desirable, many patients having neither the time nor inclination to submit to an operation which may keep them from their business or pleasures for a fortnight or more.

An excellent mode of treating hæmorrhoidal tumours in cases where it would not be advisable to apply the ligature, or where the nitric acid alone will not suffice, consists in the use of a clamp, by which the tumour is seized and compressed for a period of a few minutes; its free surface is then excised by means of a pair of scissors. The divided surface is carefully wiped, and either the strongest nitric acid or the actual cautery is applied. The clamp is now removed, and the parts being well oiled, the operation is completed. The advantage of this operation, which has been for some years adopted by the Dublin surgeons and by Mr. Henry Lee, consists in the circumstance that the dangers of the ligature are avoided, and the patient is confined to his bed for a much shorter period—two or three days sufficing. The disadvantages are, that it is a much more tedious and troublesome operation than that by the ligature, and that there is a possibility of hæmorrhage. To avoid this, however, I have lately had constructed an improved clamp, in the shape of scissors furnished with strong handles to which a light screw is attached; by this means a large degree of pressure may be exerted upon the base of the tumour, and this pressure may be gradually taken off, so that if there be any vessel bleeding, it can

be readily seen and secured. There is a description of this instrument, together with a woodcut, in the *Lancet* for October 4, 1862.

Within the last few years some French Surgeons, and especially M. Chas-saignac, have strongly recommended the employment of the *écraseur* for the removal of internal hæmorrhoids. The practice has also to some extent been followed by Surgeons in this country. The object sought by the use of this instrument is the more or less rapid removal of the tumours without hæmorrhage. That this can be effected in a great number of instances there is not a doubt; and if no evil result were likely to follow, this practice would in all probability be adopted in many of those cases where an operation was required, notwithstanding that there is a great deal of pain attendant upon the process. One very serious consequence, however, of this plan of treatment has been met with in several instances in Paris: this is the occurrence of stricture of the rectum some time after the wound has become cicatrised. This very grave objection to the employment of the *écraseur* is sufficient to counterbalance its real or supposed advantages; and although it would not be wise entirely to discard its use, the necessity for it must be rare, and in those few instances where it would be required, the Surgeon will do well to take every precaution to avoid the occurrence of contraction of the gut.

PROLAPSUS OF THE RECTUM.

During the time that the rectum is evacuating its contents in a natural and normal manner, more or less extrusion of the bowel occurs; but this is only momentarily, for as soon as the action is finished, the mucous membrane is immediately withdrawn within the anal orifice, and no inconvenience results. When, however, from some particular cause, there is any impediment to its return, those changes which ultimately lead to the disease we are considering occur; the mucous membrane becomes congested and swollen; its attachment to the muscular tissue, naturally loose, becomes weakened; and in course of time the protrusion of the membrane becomes habitual, constituting one form of prolapsus of the rectum, and that the most frequent. In other cases, however, there is a protrusion not only of the mucous and submucous tissues, but of the whole of the thickness of the lower part of the bowel as well. A preparation in the Museum of King's College puts an end to all doubt on this point. This kind of prolapsus occurs not unfrequently in children, and is of great extent, the protruded bowel being sometimes five or six inches in length. In very old people this complete prolapsus of the rectum occurs, reaching to an immense size. On examining a recent case of prolapsus of the rectum, where the least amount of change has taken place in the structure of the parts, as for instance in a child, the protruded part is found to form a tumour of an oblong shape and cylindrical form, presenting externally the smooth vascular surface of the mucous membrane, which is generally of a more or less bright-red colour, and covered with mucus; at the extremity of the tumour is the orifice

or cavity of the bowel, and at the anus there is no deep furrow between it and the protruded part, as there is in the intussusception of the rectum. Even in the adult, when the prolapse is large and of recent occurrence, this mucous membrane may be as unchanged in appearance and texture as when it occurs in the child, but the tumour has more of a globular form.

The most frequent condition in which a prolapsus of the rectum is seen is where there are one or two lateral folds of the membrane, varying from one to two inches in length, protruded from the anus; or one unbroken ring of protruded membrane is seen—but this is more rare. If the disease has not long existed, the membrane is not much changed in appearance, being only somewhat thickened and more vascular than natural; but should the bowel have been habitually prolapsed for some years, considerable changes take place, and on examining an old case the following will be the appearances. Externally there will be a ring of thickened integument; within this, the flaps of mucous membrane hang down, their lower portions being much thickened, having lost the peculiar character of mucous membrane, and being assimilated to integument; this change has taken place because the most dependent portion is that which either habitually remains protruded altogether, or is protruded for a longer time, and more exposed. On separating the flaps of the prolapsus, the upper part of the membrane is found either but little altered from its natural character, being red, smooth, and vascular, or superficial ulceration may have taken place where the two portions have been in contact. There is more or less mucous discharge produced, but in pure prolapsus there is little hæmorrhage.

Sometimes, in persons advanced in life, the protruded part consists of a tumour as big as the fist, which has habitually protruded for a long time. In such a case, a very large proportion of the tumour consists of membrane more like leather than the natural tissue. In these old-standing cases the sphincter becomes extremely relaxed, and the anus very capacious; there is generally a redundancy of loose and thickened skin around; sometimes it hangs down in long pendulous flaps,—this state of the parts adds materially to the facility of the occurrence of the prolapsus.

In many cases the prolapsus of the rectum is complicated with distinct hæmorrhoidal tumours, which in fact are mainly, if not entirely, the originators of the affection; for when one or more internal tumours exist, they themselves, each time the bowels act, become protruded, and drag portions of the mucous membrane down with them; so that not unfrequently a patient presents himself with one or more folds of prolapsed membrane, and at the same time with distinct hæmorrhoidal tumours.

The inconvenience and suffering which prolapsus causes is considerable; for although at the onset of the affection the protruded part may pretty readily return within the sphincter after an evacuation, as time wears on it becomes necessary for the patient himself to return the part, which not rarely is a task of difficulty, and attended with pain; moreover, from the contiguity of the rectum to the neck of the bladder and urethra, there is often great distress of these parts,—constant irritability, and even retention of urine, being an accompaniment of the affection; pain and uneasiness is felt in the loins and down the thighs; the intestinal canal and stomach also sympathise, the patient being troubled with flatulence, loss of appetite, and low spirits.

If the prolapsus cannot be returned by the patient, most violent symptoms occur—extreme pain in the part, and retention of urine; and if unsuccessful attempts are made to reduce the swelling, which is in all probability tightly constricted by the sphincter, violent inflammation of the part, attended with severe constitutional suffering, occurs; and in some instances sloughing of the protruded bowel takes place, by which means a cure is brought about, but the mischief may be such as to cause death. In cases where a prolapsus occurs in children to a great extent, and has been allowed to remain down for two or three days, the local and constitutional changes are not so severe; the prolapsed membrane, however, becomes exceedingly congested.

The causes of prolapsus are constitutional and local; thus, the disease is very frequently met with in individuals who have suffered from general debility and laxity of fibre. In children especially the affection is met with in instances where the health has been much reduced by insufficient nutriment, bad air, and want of proper attention. An adult or old person who suffers much from prolapsus usually has a weak pulse, a flabby tongue, and impaired digestion; and in the child there is an unhealthy and dry skin, a foul tongue, and a tumid belly. The local causes which produce falling of the bowel in children are, stone in the bladder, and ascarides. In adults, constipation, sedentary occupation, the straining caused by stricture of the urethra, and enlargement of the prostate, are fertile causes of the disease. There is no doubt, moreover, that the pernicious plan of frequently using copious enemata is very constantly productive of the disorder.

In considering the treatment of prolapsus of the rectum, we shall first refer to that which is necessary in removing the affection as it is met with in young children. In the first place, it is necessary to seek for its cause; and especial inquiry should be made with reference to the urinary apparatus, for it not unfrequently happens that it is the irritation of a calculus in the bladder which produces the extrusion of the gut; and if this be so, it is obvious that the remedy consists in the removal of the stone. If there be not stone in the bladder, a collection of ascarides in the rectum may originate the disease; and the destruction of these parasites by a few doses of scammony and calomel, together with the daily injection of a few ounces of strong infusion of quassia, will prevent the prolapsus.

In by far the larger proportion of cases occurring in children, the general health will be found at fault, and this must be attended to before the prolapsus can be got rid of. In the first place, it is necessary to return the protruded bowel; and this is sometimes a work of difficulty, because the child struggles violently and cries. The protruded bowel should be gently but firmly grasped by the right hand, well oiled; careful pressure, so as to empty the vessels, should be employed, until the whole is returned within the sphincter. When the protrusion has been large, however, and the child is very violent, the gut will soon fall again; and in this case the best plan to pursue is to place the child under the influence of chloroform, and the bowel will be readily returned. A pad and bandage should then be employed, in order to secure the part. The secretions of the liver and bowels should be rendered healthy by the use of small doses of rhubarb and hydrarg. c. creta; the skin be kept in good order by the warm bath; the child should be carried about in the fresh air; the diet must be nutritious and in small volume; and the strength and appetite are to be increased by small doses of the pulvis cinchonæ and soda. As the health improves, the prolapsus will cease to appear; but should this persist, the part may be bathed with a solution of sulphate of iron, gr. j. to ʒj. of water; or an injection of

tincture of sesquichloride of iron, ʒj. to ʒvj. of water, may be thrown up every morning after the evacuation of the bowels, and after the protrusion has been returned. In some cases the prolapsus will recur whenever the child evacuates. This accident, however, may be prevented by so managing that the child should be in a kneeling posture during the act. Another plan which sometimes succeeds in preventing the protrusion, consists in an attendant drawing on one side the skin of the anus with some force during the time the bowel is being emptied; by this means a certain amount of temporary contraction is produced, which prevents the descent of the gut. In adults, a considerable number of the cases which are not severe, and which have not been of long standing, may be cured by careful attention to the removal of those causes which have produced the disorder. Thus, if it has resulted from violent straining and constipation of the bowels, some mild aperient should be exhibited occasionally, which will prevent accumulation in the bowel, and render the contents more fluid. The compound rhubarb-pill at night will have this effect; or, what is perhaps better, one or two teaspoonfuls of confection of senna should be taken. The patient should not eat largely, and should especially avoid vegetables in any quantity. He should take exercise, and be careful to use plenty of cold water to the parts after the action of the bowels. Occasionally a little cold water, or a few ounces of the decoction of oak bark, may be thrown up the rectum; and if there be the least protrusion left after the evacuation of the bowels, the gut, having first been well sponged, should be carefully returned.

By attention to these various measures a prolapsus of small extent may either be entirely cured, or be prevented from increasing or proving troublesome. And therefore it is of the highest importance to place reliance upon medical treatment in such cases. In by far the majority of cases, however, which are presented to the notice of the Surgeon, the prolapsus is either very large, or has existed so long a time that medical treatment will be of no use whatever. And then some strictly surgical means must be adopted, if a cure, or even if palliation of the disease, is looked for. If the case is of only recent occurrence, and yet the prolapsus be very voluminous and incapable of being returned, thereby causing much alarm and suffering, it is the duty of the Surgeon at once to reduce the prolapsed bowel. This is best effected by placing the patient on his side, with his knees drawn up, and grasping the tumour either with the naked hand well oiled, or with a cloth intervening. Firm and steady compression should be used, until the whole of the tumour be returned within the sphincter. The patient should then lie quiet for some hours, and afterwards a pad should be applied to the anus, and be secured by a firm bandage across the perineum and around the loins. In order to prevent a return of the prolapsus, the whole or greater portion of the mucous membrane should be smeared over with solid nitrate of silver, previous to its being returned by the Surgeon. In one remarkable case of immense size occurring in a young man, I adopted this plan, with the result of obviating the necessity of a bandage, which he continually had worn before.

In order to bring about an effectual cure of the chronic and severe cases of prolapsus, more decided means must be adopted. We have seen that the disease essentially consists in a relaxed and thickened condition of the mucous membrane, and a separation, as it were, of this from the muscular coat. When this is involved also, there ensues a weakness and detachment of the whole of the thickness of the bowel from the surrounding supports. The object to be obtained is to reduce the redundancy or relaxation of the mucous membrane, to promote adhesion between the several tissues composing the bowel, and to brace up the anus and the sphincter. The late Mr. Hey of Leeds was the first to propose a proceeding which insured the latter result; and this consisted in removing the loose and pendulous flaps of skin which existed around the margin of the anus, in the case alluded to by him in his *Practical Observations on Surgery*, p. 443. In some cases, where the sphincter is very relaxed, and the flaps of integument loose and thick, a cure may be brought about by the removal of these alone; but when the prolapsus is very large, and a considerable portion of the mucous

membrane has become converted into tissue approaching to integument, it will be necessary to adopt the modification of the operation proposed by Dupuytren, which consists in removing radiating folds not only of the skin at the margin of the anus, but also portions of the diseased mucous membrane. This operation is effected by laying hold of the fold of skin on each side of the anus with forceps, then with a sharp curved pair of scissors removing both skin and mucous membrane. In very severe cases four or six applications of the scissors may be necessary; the operation is painful, but is soon accomplished; as the wounds heal, contraction takes place, the aperture of the anus becomes diminished and braced up, and the prolapsus no longer occurs.

It is important to bear in mind that, in very severe cases, not only is it necessary to remove the relaxed integument, but portions of the mucous membrane, which in instances of long standing has become converted into a tissue more like leather than any thing else, must also be taken away: if this step be not resorted to, a disappointment will ensue as regards a complete remedy of the prolapsus. Hence the Surgeon must think of the possibility of somewhat severe hæmorrhage, which will occasionally occur. After a portion of the mucous membrane, however small, has been snipped away, I have seen it occur to a very great extent, and when it was least expected.

If hæmorrhage to a large extent does occur after a surgical operation on the rectum, the patient will in a few hours complain of tenesmus, and express a desire to go the closet; he will then evacuate a large quantity of blood, and become faint. In such a case it will be necessary to clear away any coagula which may be in the gut, to elevate the pelvis, and introduce some ice into the bowel. Should this not stop the bleeding, a careful examination should be made with a speculum, and the bleeding orifice be looked for and tied. Sometimes it will be difficult, or almost impossible, to effect this; and then the rectum must be carefully plugged by portions of sponge or lint, to which a thread should be tied, that the compress may be more readily withdrawn when the bleeding has ceased.

It may here be stated, that the risk of severe hæmorrhage after the mucous membrane has been excised may be in a great measure obviated by the Surgeon taking care to introduce, through the edges of each incision, one or more fine sutures before the patient is left.

Another mode of curing prolapsus consists in the application of the ligature to portions of the prolapsed membrane. This plan is especially adapted to those cases where there is great laxity of the mucous membrane, and where the surrounding integument is not much involved; also to those cases where the prolapsus is associated with one or more hæmorrhoidal tumours. This operation was originally proposed for prolapsus by the late Mr. Copeland, who found it to answer his expectations most admirably. It is easily done, by pinching up, with a pair of forceps, small portions of the diseased membrane; applying around each a tight thread, cutting off the extremities, and returning the parts within the sphincter. If there are distinct hæmorrhoidal tumours to deal with, the operation as undertaken for them, and described in another place, must be performed. As the prolapsus is in a great measure the result of the hæmorrhoids, the cure of the latter will be followed by the disappearance of the former.

In either of the operations just described, however, there is a certain amount of danger, and they compel a close confinement to bed and to the house for a week or two; and therefore, if there is any other agent by which the prolapsus may be remedied, without producing either the danger to life or the confinement to bed, it should be adopted. The *strong nitric acid*, which, locally applied to some forms of hæmorrhoids, is found to act so well, has lately been used by me in some severe and long-standing cases of prolapsus with considerable success. It is, however, only in certain forms of the affection that the remedy will act beneficially. In the cases of prolapsus of large size and of very long standing, where the mucous membrane has become very much thickened, and changed in its structure and appearance, the acid will do little or no good; but in those cases of simple prolapsus of the bowel where there are one or more

large folds of mucous membrane, and where the tissue is extremely vascular, presenting the appearance of smooth velvet, or is perhaps superficially ulcerated and readily bleeds, the strong nitric acid, applied carefully to the whole or the greater portion of the diseased membrane, will act like a charm. It should be used in the same manner and with the same precautions as when employed in instances of hæmorrhoids. If the entire surface of the prolapsed membrane be touched with it, one application alone will suffice to get rid of the disease; but it is better to apply the acid to a part only, and thus two or three operations may be necessary. This remedy, when carefully used, generally causes less pain than when it is applied to hæmorrhoids; for the mucous membrane, after having been long prolapsed, generally becomes much less sensitive than it is when in its usual condition.

Cases of prolapsus are occasionally met with in persons of very advanced age, or who are suffering from some internal disorder which would forbid the employment of the ligature. Probably there is, in conjunction with an extensive prolapse of the mucous membrane, a very weakened condition of the sphincter, and an abundance of loose and thickened integument around the anal orifice; consequently the use of nitric acid alone will not suffice to remedy the disorder, even if the mucous membrane be not much altered in its character. In such cases I combine the use of the nitric acid with the removal of two, three, or four slips of the thickened integument from around the margin of the anus. The acid should first be thoroughly applied to the mucous membrane on one or more occasions; and after the lapse of a few days the subsequent part of the treatment should be adopted by using the scissors in the manner before described. Most beneficial results will follow from this practice, and it may be undertaken without fear of danger in cases where the ligature would not be justifiable.

In those cases where any operative measure is not advisable, great relief may be obtained by the use of a pessary or spring pad.

FISTULA IN ANO.

The artificial communication between the cavity of the rectum and the neighbouring textures denominated fistula in ano constitutes an affection of very great interest and importance, as there is a difference of opinion regarding the exact pathology; and for the most part an operation more or less severe is required for the cure of the disease.

Very opposite opinions have been propagated by eminent Surgeons regarding the formation of fistula. Thus, it has been confidently asserted by Sir B. Brodie that the origin of the disease was the existence of an ulcer in the mucous membrane, and that the suppuration in the neighbouring textures was subsequent to and dependent upon this ulceration. On the other hand, it has been as confidently stated by Mr. Syme that the first step in the formation of this disease was an inflammation and suppuration in the cellular tissue external to the bowel, and that the abscess subsequently opened into the gut, and thus the fistula was constituted.

There can be no doubt that the disease originates in both ways. We are acquainted with the fact that inflammation and ulceration of the mucous coat of the rectum occurs both spontaneously and as the result of injury produced by foreign bodies; ulceration having occurred, some of the contents of the rectum escape into the surrounding cellular tissue, and excite suppuration.

In the majority of cases of fistula in ano, the first step in the formation of the disease is the existence of an abscess in the cellular tissue surrounding the bowels; as the matter increases, the various textures are involved, the cavity of the bowel is pressed upon, the mucous and muscular coats are separated to a

greater or less extent, and at last the former membrane is penetrated. It has been asserted that the correct appreciation of the true pathology of fistula is of little consequence; but it is almost impossible to mention a surgical disease where it is more needful to know the steps of its formation; for the prevention of the malady, which must ever be looked upon as of more importance than its cure, depends almost entirely upon our knowledge of the fact, that in a great number of cases suppuration outside the bowel is the cause, and not the effect, of the disease.

When suppuration has taken place in the areolar tissue around the rectum, and the matter has discharged itself, the cavity of the abscess commonly does not heal, in consequence probably of the periodical disturbance to which it is exposed by the action of the sphincter; and thus it degenerates into a fistula, which, when it is perfect, communicates at one extremity with the bowel, and at the other with the external surface. In consequence of the tendency in matter to spread where there is little resistance, or where from position it may become dependent, burrowing takes place in various directions about the inferior portion of the rectum, and several openings may form near the anus. In a great number of cases only one external opening is met with, and this is situated generally about half an inch from the circumference of the anus. In the other cases of a more severe kind, where there has been extensive burrowing of matter, there are two or three openings situated at a greater distance from the anus,—as, for instance, over the ischium or in the perineum,—and the matter may even extend upwards, and open in the groin.

The external opening may present itself as a simple minute puncture, and when situated close to the anus may be so hidden between the folds of the integument as readily to escape observation, unless it be carefully looked for; the only thing which marks its presence being a slight moisture escaping from one point when pressure is made. In other instances of more extensive and old-standing disease, the opening or openings present themselves as somewhat prominent apertures, not unlike those seen in connexion with dead bone, and surrounded by more or less erythema of the skin, so that there is not the least difficulty in finding them.

Although for the most part it will be found that the external opening of a fistula is by the side of and some little distance from the anus, it is well to know the fact that sometimes it is so close to the circumference of the anus that it is necessary for the patient to protrude the parts well before this aperture can be discerned.

An external opening does not always exist, and then is constituted what the older Surgeons named a blind or incomplete fistula. This form of the disease is somewhat rare, and it is very likely to be overlooked or misunderstood.

The internal opening of a fistula nearly always exists; and indeed, according to that view which looks upon the formation of the disease by preliminary ulceration of the mucous membrane, an opening must necessarily obtain; but there is no doubt that there are cases of incomplete fistula where there is no opening into the bowel; an examination on the living body alone might not be a sufficient proof of this, for the opening may exist, and not be ascertained; but no such source of deception can occur after death. There are three specimens in St. George's Hospital Museum, as well as two preparations in the Museum of St. Bartholomew's Hospital, which show this. On careful examination, however, it will be noticed that the mucous membrane of the rectum at the spot where the opening would have existed is very much thinned.

Formerly it was considered that the internal opening was situated much higher up than is really the case. Subsequent investigations, however, and especially those instituted by Sabatier, Ribes, and Velpeau, have proved that in the larger number of instances the internal opening is situated within an inch or an inch and a half from the anus. In more rare cases, however, it happens that the internal opening will exist as high up as three inches from the anus. It is rare that more than one inner opening exists; and it has been affirmed by a recent writer that it is always single; but this is an error, as cases are occasionally met with where there are two or more distinct apertures in the

gut. And it is easy to understand how this occurs; for in some of the more severe cases of abscess near the rectum the matter extends and strips up the gut, separating it from the cellular tissue to the extent of three or four inches; and it is but likely that the mucous membrane should become thinned, and ultimately perforated, by the pressure of the matter, at more points than one.

The course which the sinus takes differs; it may be simply subcutaneous. Very frequently it runs through the fibres of the external sphincter, or it may be found to traverse the substance of the levator ani. In one very beautiful preparation in St. George's Hospital Museum the fistulous canal is shown to be running closely beneath the fibres of the internal sphincter.

Sometimes the result of extensive suppuration around the lower part of the rectum is the formation of a double fistula, either complete or incomplete; that is to say, there may be a fistulous tract on either side, having an internal as well as an external aperture; or a sinus may exist on either side of the bowel, and yet there be only an opening into the latter on one aspect; or there are two sinuses, one of them opening both into the bowel and on the skin, whilst the other has only an internal aperture. There is occasionally also a curious condition, where the fistulous sinuses surround the back part of the rectum, and have a common opening in the bowel; this form of the disease has been not inaptly called the *horse-shoe* fistula. In very severe cases the sinuses are found to be branching out across the buttock in various directions; this state is not uncommonly associated with stricture of the bowel of either a simple or malignant character. In an instance which I lately saw in consultation with Mr. Holberton of Hampton, the sinus extended so far down as the lower third of the thigh posteriorly. The fistula in this case was the result of stricture one inch from the anus.

The causes which produce fistula are various, and, understanding its pathology, we must look to those circumstances which are liable to excite inflammation and suppuration about the rectum. In some rare cases the disease is of a traumatic origin. Thus a fish-bone may have adhered to the mucous membrane of the rectum, and produced ulceration and subsequent abscess, which has degenerated into fistula; or the ulceration may have primarily taken place in the mucous membrane in persons who have suffered from severe dysentery. In the greater number of cases, however, when abscess has been the primary step, the morbid action has been idiopathic, occurring in persons who have been out of health, or who have been ill from some specific disease. Those who have lived long in tropical climates, and who have suffered from disease of the liver, are doubtless more liable than others to get fistula. A violent blow upon the perineum or ischio-rectal region will produce abscess which will terminate in fistula. I have recently operated upon a very healthy young man where the disease could be traced to this source.

When an inner opening exits without any external aperture, the diagnosis is somewhat difficult. The patient will complain of having suffered from more or less pain about the rectum; this had

gradually become more severe, until there was perhaps some alleviation, accompanied with a discharge of purulent matter from the anus. On examination, the Surgeon will detect a distinct and circumscribed induration by the side of the anus, very painful to the touch; and on pressing the part towards the anus purulent fluid will be observed to escape in considerable quantity. And when the integument has become thinned, fluctuation may be discovered; but not in all cases.

It should not be taken for granted that, because a sinus exists close to the anus, it must be connected with the rectum; for abscess and fistulous openings may exist in connexion with disease in other parts. Thus sometimes an ordinary pelvic abscess may discharge itself close to the anal aperture, or an abscess in communication with the hip-joint will open into the ischio-rectal fossa. An abundant discharge from a cavity connected with the prostate gland took place in this situation in a recent case under my own care. Necrosis of the tuberosity of the ischium or of the extremity of the sacrum may exist, and the aperture in connexion with the disease may be present in the same situation. I attended an elderly gentleman some time since who had suffered for several years from a fistula. Two operations had been performed upon him by a most eminent Surgeon, but the fistula remained unhealed. When he came under my observation a most careful examination was made with the view of detecting the cause of the failure of these operations; and by passing the probe up to the posterior part of the rectum, a portion of necrosed bone was felt. The fistula was freely incised, and a small piece of the sacrum was removed. The existence of this disease had been overlooked, and hence the failure of the two previous operations, which had been performed as for an ordinary fistula in ano. I may mention, that after the third operation the patient perfectly recovered.

In order to bring about the cure of a fistula in ano, it is necessary in the great majority of cases to perform a surgical operation, which fortunately, from the attention devoted to this disease by Pott and others, is a much more simple business now than it was in former days; and if proper judgment be used in selecting the cases, this operation is almost always attended with success.

Before, however, proceeding to consider more especially the treatment for the disease when the fistulous communication has been formed, it is necessary to make some observations on the importance of dealing promptly with the inflammatory and suppurative process which forms the first stage of the affection. When a patient is suffering from the symptoms of threatened abscess near the rectum, he should lie in the recumbent posture, and the bowels should be thoroughly evacuated by a dose of calomel, followed by castor-oil; hot fomentations and poultices should be assiduously employed, and the diet must be sparing. By the early adoption of these measures threatened abscess will be arrested, and all the symptoms subside. If, however, there be good reason to

believe that matter has already been formed, it will be necessary, in order to prevent a fistula, to make a free incision into the centre of this swelling with a narrow sharp bistoury. In some cases, where the pus is deeply seated, the point of the knife must be passed much farther than would at first appear to be necessary. In such a case the evacuation of the abscess will be facilitated by the introduction of the left forefinger into the gut; by its assistance the swelling may be pushed forwards and made more prominent. When the abscess has been opened, it will be prudent to insert a small portion of lint into the aperture, in order to prevent its closure. The part should then be well poulticed, and the patient should remain quiet during a few days.

In many cases, where the inflammation of the cellular tissue has not existed long, and where the general health is not much at fault, an abscess close to the rectum will completely heal by this prompt evacuation of its contents, and thus the fistula will be prevented. Hence is shown the vast importance of properly understanding the pathology of this disease, and thereby being able to arrest it in its first stage.

In those cases, however, where there has been extensive mischief, and the lower part of the rectum has been much denuded, or where the general health has been weakened from this or some other cause, even this prompt surgical treatment will not prevent the abscess from degenerating into a fistula; and in other very numerous cases, the abscess has been allowed to burst, and the fistulous communication between the gut and the external surface has been formed.

In some cases where the sinus is short and free from induration, it may be made to heal by the employment of irritating injections thrown into the canal. Those which are likely to prove of most service are injections composed of the pure tincture of cantharides, or of the tincture of iodine undiluted, which should be used daily. Another method of healing these fistulæ consists in irritating the sinus by passing a silver probe covered at its extremity with fused nitrate of silver. Each of these measures is occasionally successful, especially when, at the same time, the general system is improved by medical treatment and by change of air. Therefore, in those cases where there is no cause for hurry, or where the patient is unwilling to undergo an operation, these means of cure should be tried perseveringly, and both patient and Surgeon will sometimes be rewarded with success.

Fistula in ano may be treated successfully by ligature, and it is a method which has of late years been warmly recommended by Mr. Luke. The operation is effected by passing a common ligature, by means of an eyed probe, through the external aperture into the bowel; then adapting the two ends of the thread to a small screw, which can be tightened from time to time as the ligature is cutting its way out from the fistula. The process of separation is generally completed in a week or ten days; and as the ligature ulcerates away, the cavity behind becomes gradually filled up. The mode adopted and the instruments used by Mr. Luke are described in the *Lancet* for 1845, p. 221.

There are some advantages in the ligature. Thus, it may be employed without fear of producing hæmorrhage; and therefore in those rare instances where the inner opening of the fistula is situated high up, and where serious bleeding may be expected to arise after a cutting operation, this mode of treatment should be adopted. Again, there are patients every now and then to be met with who are so nervous about a cutting operation, that even with the promise of chloroform they will not submit to the knife; in such the treatment by ligature can be advantageously substituted. It is not a method adapted to cases where the sinuses are very tortuous and extend in various directions; but in those instances where the fistula is simple, there is no doubt that the application of the ligature will be followed by success, although the process is a somewhat tedious one, and sometimes it has to be abandoned in consequence of the pain and annoyance caused.

In by far the majority of cases of fistula in ano, an operation by the knife—that commonly denominated *the operation for fistula*—is needed, if a satisfactory and efficient cure is looked for. This consists in the division of the structures

situated between the sinus and the cavity of the intestine, and, in fact, the laying open of the entire fistula from one orifice to the other. This proceeding is rendered necessary in many cases of obstinate sinuses situated in other parts of the body; and it is easy to understand how imperatively it is called for when a sinus implicates a part periodically acted upon by a powerful sphincter muscle, whose contractions alone will suffice to prevent the healing of the fistula, even were there no other causes at work to impede this process. The object, therefore, of the Surgeon in performing the operation is not only to lay the sinus open, and thus place it in a more favourable condition to heal, but by dividing the sphincter muscle to paralyse its action for a time, and thus to keep the wound at rest,—a proceeding found to be essential for a cure, not only here, but in the treatment of wounds, sores, or injuries in other parts of the body.

The operation, as performed now, is, in the majority of cases, a simple one, compared with the same before, or even after, the days of Pott, whose writings tended so powerfully to diffuse correct views regarding the pathology and treatment of fistula in ano. Instead of excising the fistulous tract, or even of making very free incisions high up in the gut, the Surgeon only finds it needful to divide those structures which are limited by the two orifices of the sinus; and it is now pretty clearly ascertained that in the majority of instances of the disorder the inner opening is met with at a point not higher than an inch, or little more, from the anus; and it is not necessary to carry the incision higher into the rectum, even though the sinus may extend for some distance by the side of the bowel above the opening.

The operation is performed in the following simple manner:

The patient, who has had the bowels well cleared out previously both by castor-oil and by an enema, and who has been rendered insensible by chloroform, lies upon his side; an assistant separates the buttocks. The operator introduces his left forefinger, well oiled, into the rectum, and then passes a curved, narrow-bladed bistoury with a blunt point through the external opening, and carries it along the sinus until the point is made to enter the bowel through the internal opening and to come in contact with the forefinger, the bulb of which is turned towards the orifice of the sinus. This being effected, the Surgeon, by a kind of sawing motion with the hand holding the knife, and assisted by the left forefinger, pushing the instrument downwards, divides the whole of the structures between the sinus and the anus, bringing out both knife and forefinger together. In those cases where the sinus is single, this one incision is alone necessary; but where there are one or more tracks branching off, the bistoury must be carried along them, so that the undermined integument may be fully opened and the wound made one.

If it has been ascertained that an internal opening does not exist, the knife must be forced through the mucous membrane into the cavity of the bowel at that spot where the tissue is found to be thinnest, and the operation should be then completed. It is not necessary to carry the knife to the very extremity of the sinus, if this extends to a considerable length, whether there be an inner aperture of the fistula or not.

After the operation is completed, a small strip of oiled lint should be placed lightly between the edges of the wound, but there should be no plugging or thrusting in of large pieces; a pad and bandage may then be lightly yet firmly placed over the parts; the patient should be kept quiet in bed, and should have a dose of chalk-mixture and laudanum, in order that the bowels may be confined; his diet should be such as not to cause much faecal accumulation. At the end of three days a dose of castor-oil should be given; and after the bowels are evacuated, the wound should be cleansed and dressed again. A small portion of lint should be introduced from day to day within the edges of the wound; and if it look flabby, a solution of sulphate of zinc or of copper may be employed by means of the lint. In the majority of cases, if there be nothing adverse, the wound made in the operation will heal up soundly in two or three weeks. In some cases, however, without any appreciable cause, the healing process will be retarded; a useful remedy in such a case is the confection of black pepper, in drachm doses, every night; or it may be needful to send the

patient away for change of air, when the wound, which has hitherto become stationary, will often rapidly put on the healing process again.

Before undertaking the operation for fistula, the Surgeon should take especial care to examine the patient, not only locally, but as to the general state of health; for this disease is not unfrequently complicated with other morbid states, which may either render any cutting operation unadvisable, or may induce delay in order that some preparatory measures may be adopted. Thus it is well known that fistula in ano is not unfrequently associated with pulmonary disease; and if this be found to exist, it certainly would not be prudent to perform the operation, unless the suffering from the local affection should be very great, and the mischief in the chest be very slight. If the fistula be cut when the patient is suffering from phthisis pulmonalis, the wound in the majority of cases will not heal up, even though life may be spared for a considerable time.

There are other cases also where fistula is met with in the persons of those who have had their health broken down by a long residence in hot countries, and have suffered from dysentery and disease of the liver; or cases are seen where either the liver or kidneys have become structurally altered by free indulgences in ardent spirits. An operation in such instances is generally to be avoided, unless there be some urgent reason for its adoption.

When a fistula is connected with a stricture of the rectum, a careful consideration of the case is required. If the obstruction be of a malignant nature, of course any operation is not to be thought of. It may, however, be somewhat difficult to ascertain at the early stage of the affection whether the stricture be of a malignant character or otherwise, and the fistula in connexion with it may have been divided. In this case, either this wound will not heal, or its cicatrix will put on a scirrhus character. I was last year called to see a middle-aged woman, who had been operated upon on two occasions for fistula, unsuccessfully, by a Surgeon of large experience. On examination, I found that the wounds had only partly healed, and had taken on a scirrhus character. On examining the rectum, I found that there was a firm indurated stricture, about an inch up, and there was much hardness about the parts altogether. I gave an opinion at the time, that it was a question whether the disease was not of a malignant character, although the features were not decided. At any rate, the ill success attending the operations for the fistula was due to the existence of the disease, which perhaps at the time was overlooked. I ascertained from a medical friend that this woman died six months afterwards, and that the disease had manifested itself as cancer.

If a fistula be complicated by a simple stricture of the rectum, and this latter be overlooked, the operation will in all probability fail. When the stricture is recognised, preliminary treatment is to be employed before the knife is used. The contracted part should be dilated by the bougie, and subsequently the sinus is to be laid open; during the after treatment, too, this use of the bougie must be strictly adhered to, otherwise contraction will recur, and the sinus will not close. When the inner opening of the fistula is situated above the stricture, this latter may be divided at the same time that the sinus is laid open; but it is better even in such a case to employ the bougie prior to the operation, if there be not any decided objection to this proceeding.

Every now and then a weakness or entire loss of power of the sphincter occurs after its division, more especially in those instances where two or three operations have been rendered necessary. In three instances which have lately presented themselves to my notice the operation had been repeated thrice in two of the patients, and twice in the other. In two out of the three the loss of power was complete; when it is but partial, recovery may take place after the parts are thoroughly and soundly cicatrised.

In some rare cases there will be an external opening on either side of the rectum, with only one inner aperture. It then becomes a question as to what should be done. The operation performed on that side where the inner opening exists, together with slightly enlarging the mouth of the sinus on the other, will sometimes suffice; but if this is found to be ineffectual, both the fistulous tracks must be freely incised. The objection to this double operation consists

in the circumstance, that loss of power over the sphincter may ensue. When there is a complete fistula on both sides, a double operation must be performed, and it should be effected on one occasion.

ULCER OF THE RECTUM AND ANUS.

The lower part of the rectum and the immediate circumference of the anal orifice are subject to ulcerations, which are peculiarly interesting and important, inasmuch as their existence is attended with some striking phenomena; they are productive of an excessive amount of suffering, and when carefully and judiciously treated are easily remedied. The various breaches of surface which are found involving either the mucous membrane or the skin itself at the extremity of the rectum, although differing in regard to situation and size, have this one common feature, viz. acute sensibility. There are, perhaps, few instances of morbid action so limited, producing such extreme distress and discomfort as painful ulcer of the rectum. The reason is obvious—it is the periodical action of the sphincter which causes this great sensibility, independent of the usual amount of pain experienced from the presence of ulcerations existing at the outlets of the cavities of the body, as for instance the lips and urethra.

The simplest form in which these ulcerations are met with is that where there is a breach of surface at one or more points around the anus, not extending within the orifice; in such a case the entire extent of the mischief may be readily detected, if the patient be told to extrude the parts. On introducing the finger into the rectum, the mucous membrane is felt to be quite healthy; the patient complains of a smarting as the motions are passed, and the uneasy sensation or pain remains only for a few minutes, then goes off entirely: it is necessary to attend to this point very carefully in the examination of such a case, for by this means shall we be able to determine between this and the ulcer which is seated within the sphincter.

These ulcerations are for the most part observed in persons who are not attentive to cleanliness, and more especially in the lower orders of prostitutes, who have suffered from vaginal discharges; in all probability the mere mechanical contact of the gonorrhoeal matter with the sensitive skin around the anus, and its retention there, are quite sufficient to produce the mischief.

The treatment necessary in such cases is, firstly, strict attention to cleanliness; the patient should be desired to apply warm water to the parts two or three times a day thoroughly, by means of a

sponge. The solid nitrate of silver should be used once or twice to the ulcerated surfaces, and subsequently the application of the red precipitate ointment or of the *lotio nigra* will bring about a speedy cure. It will be necessary to attend to the state of the bowels; and the Surgeon should not forget to inquire if there be any vaginal discharge; and should there be any, to put a stop to it by suitable injections.

The variety of ulcer next to be considered, and that which is more frequently seen by the Surgeon, in consequence of the greater distress which accompanies it, is that where the ulceration is situated partly without the anus and partly within the rectum. The existence of this form of ulcer is not unfrequently overlooked, because, although the symptoms are peculiar and striking, the pathological change causing them is not readily detected, unless by one accustomed to look for it. The patient who is suffering from this form of the affection will complain of having what he terms the piles; on questioning him closely, it will be ascertained that there is not any protrusion, but that he feels more or less acute pain in passing the contents of the bowels. This pain, instead of diminishing, increases in severity after the act, and lasts for a considerable time, varying from a quarter of an hour to four or five hours; it then ceases, and there is no suffering until the bowels are again moved, when a repetition occurs; and as time goes on the symptoms become more severe. There is also in some cases a discharge of blood, and in all more or less purulent discharge. On examination there will be nothing visible externally, with the exception, perhaps, of a small excrescence or pile about the size of a currant; and this is found in a large proportion of cases of ulcer of the anus and rectum, and is a sign of great importance. On requesting the patient to protrude the parts as much as possible, and separating the sides of the anus very carefully, the ulcer will be seen situated at the base of the little tumour, which in nine cases out of ten is at the posterior border of the anus. In one case the ulcer may be only the eighth of an inch in length, and its extent may be defined by the eye alone; in another instance it may be more than half an inch in length, and, extending beyond the verge of the anus, implicate the mucous membrane of the rectum itself. When this is the case, the limit of the ulcer cannot be seen, but it is necessary to introduce the finger into the rectum, when the peculiar and roughened sensation caused by the breach of surface is readily detected by a practised hand. This introduction of the finger is accompanied generally with excessive pain. The ulcer may be either round or

oval. In one case lately under my care there was a peculiarity regarding this; for instead of there being only one external excrescence posteriorly, two existed, a little apart from one another, and an ulcer of considerable size extended from the base of either of these tumours to within the sphincter, narrowing as it encroached upon the cavity of the gut, thus forming a complete triangle, with its base towards the tumours. Instead of being so large as this—which is rare—the ulcer may not be bigger than a large pin's-head or a small split-pea; its surface is either smooth, the mucous membrane, when the very verge of the anus is the seat, being simply denuded, or it is somewhat rough and excavated when the integument is more implicated, and the appearance of the ulcer presents a healthy red or ashy-gray colour. In some cases there are two ulcers, separated more or less by a raised process of integument, so as to become nearly distinct.

It is extremely important to employ the greatest care in the investigation of these cases; for a small ulcer may be easily overlooked, in consequence of the rugæ around the anus enveloping the part and hiding it from sight. It is well, therefore, when this disease is suspected, to have a good light, and to take care that the examination be not made until the bowels have been well evacuated and the parts well cleansed. With regard to the pathology of this affection, it is difficult to come to any correct conclusion. In all probability some breach of surface, at first slight, is produced by violent straining; and from the periodical movement of the part, and want of cleanliness and attention to the bowels, the ulceration increases, and assumes the definite form in which it is presented to our notice; in other cases probably the commencement of the disease consists in circumscribed inflammation and abscess ending in ulceration, which is limited to the mucous membrane or skin respectively. In most cases the sphincter is found to act very strongly, so that considerable opposition is made to the entrance of the finger when it is introduced for the purpose of examination. This spasmodic condition of the sphincter ani is supposed by some writers, as Mr. Copeland and Mr. Syme, to constitute a peculiar affection; but it is doubtful whether the effect in question is not rather one of the prominent symptoms of an ulcer at the orifice of the anus. There is good reason to believe that, in all or most of these cases of spasmodic constriction of the anus, a diligent search would bring to light some slight ulceration or excoriation, on which the symptoms depend. One of the most recent authors of repute, Mr. Quain, holds the view that the sphincter is but secondarily or sympathetically affected, and that the painful spasm is not a disease in itself.

The treatment of this affection consists either in the employment of local agents, or in the use of the bistoury. In those cases where the ulceration is only of slight extent, is not carried far within the sphincter ani, may be comprehended by the naked eye, and the symptoms have not long existed, a cure may be brought about by careful attention to the bowels, by the employment of rigid cleanliness, and by an occasional application to the ulcerated spot of the solid nitrate of silver or sulphate of copper. After the sore has been touched once or twice, the effect will be, in those cases which will be benefited by this treatment, a considerable mitigation of the severe pain which has troubled the patient when at the closet and afterwards; and the sore, instead of presenting the grayish appearance which is usually observed, puts on healthy granulations, and slowly contracts in size. In order to assist this process, a lotion of sulphate of copper or sulphate of zinc, one grain to an ounce of water, should be applied two or three times a day; or if these do not succeed, the ordinary black wash

may be used with benefit. The daily introduction of a full-sized bougie, made of wax or of yellow soap, will sometimes act beneficially, by distending the sphincter, and producing such an amount of irritation as will set up a healing process in the sore.

In the more severe cases, however, this local treatment will fail to produce a cure; and there are some persons who have been brought to such a state of suffering, local and general, that it will be unwise to trust to measures which either may not succeed, or which may be slow in giving relief. A modification of the operation which was originated by the French Surgeon Boyer, and which consisted in the division of the sphincter and the tissues around, is now generally undertaken by the best Surgeons, and is found to be successful in remedying this affection. The French Surgeon and those who had adopted his operation were induced to make a complete division of the sphincter ani, under the impression that the muscular constriction was the cause of the ulcer, and that the pathological effect could not be removed unless the action of these fibres was temporarily destroyed. This severe operation doubtless succeeded in bringing about a cure; but it was reserved for the late Mr. Copeland to show that it is only necessary to make a fair incision through the ulcer or fissure itself without cutting the sphincter. Sir B. Brodie, Mr. Syme, and Mr. Quain have also advocated in their writings this limited operation; and it is now almost universally acknowledged, that if the ulcer be fairly divided in its long axis, the same relief is produced as though the sphincter was divided, and the operation itself is much less severe and painful. The relief which is given to the patient is most remarkable. In a few hours the aspect of suffering, which is so well marked in most of these cases, is almost entirely removed; and even on the first evacuation of the bowels after the operation, the patient feels scarcely any pain beyond that produced by the raw surface of the wound.

The operation itself is simple and easy of execution. The bowels having been well cleared out previously by a dose of castor-oil or an injection, the Surgeon should then take a straight, narrow-bladed, sharp knife, and having passed his left forefinger into the rectum beyond the extremity of the ulcer, he should introduce the point of the knife very carefully, and commencing his incision above the ulcer, carry the cutting edge fairly and quickly through the centre of the sore or fissure. It is absolutely necessary to include the whole length of the sore, and not to cut to one side; and therefore it is well that an assistant should open the orifice of the anus as far as possible, in order that a good view of the greater part of the ulcer should be obtained by the operator. There is very frequently a small external pile or thickened fold of integument at the base of the sore; this should also be removed, as well as any other pendulous flaps of skin which may encircle the anus. Scarcely any dressing is required after this operation; a small strip of lint dipped in oil may be introduced, and kept in for a day or two, but it is not necessary. It is as well to give an opiate after the operation: in the first place, to lessen pain; and secondly, to prevent the action of the bowels, which should not be allowed for two days or more; and then this action should be produced artificially by a dose of castor-oil. The wound should be daily dressed with a dossil of lint dipped in a weak solution of sulphate of zinc and water. This dressing is not absolutely necessary; but there are some cases in which the wound becomes sluggish, and then a slight stimulation is desirable. The use of the *confectio piperis nigri* will assist the healing of the wound after this operation, as after that for rectal fistula.

Certain precautions and modifications with reference to this operation have been suggested by surgical authors: thus Sir B. Brodie has cautioned Surgeons not to make the incision towards the vagina in the case of a female, for fear of the occurrence of loss of power over the sphincter vaginae; others have suggested that the incision should be made on either side of the anus, in order that the sphincter muscle should be effectually divided: but now that it is not found necessary to do more than simply incise the ulcer, and in the most severe cases only to divide some of the fibres of the sphincter, the Surgeon need not obey either of these injunctions, but be content with making a fair incision through the diseased part, wherever it be situated. The posterior part of the anus is

found to be the seat of the affection in by far the majority of cases; sometimes the ulcer is found on one side, and very rarely it is seen on the anterior aspect; thus, out of twelve cases which I have recently met with, the ulcer existed in front only in one instance, whereas in all the others the disease was seated behind.

It has lately been recommended in France, that an operation effecting the same purpose as division of the ulcer should be performed. This consists in the forcible tearing open of the sphincter by the introduction of the two fingers into the anus, and using extension. There has been sufficient evidence placed before the profession to prove that this mode of dealing with fissure of the rectum is attended with success; but it is a proceeding so rude and unsurgical, that we trust the Surgeons of this country will not forsake the simple and effectual means we have described when any operative measure is required.

There is a form in which *fissure of the anus*, in the true sense of the term, occurs, and which should not be considered as the same affection we have before described, although they are by most writers classed together under the same head. Thus the ulcers of the lower part of the rectum and anus are called by several surgical authorities *fissure of the anus*, whereas the term 'ulcer of the rectum' is much more applicable; for although to a careless observer the disease may have only the appearance of a fissure, on a more careful examination there is found to be a well-defined breach of surface, varying from an eighth to a quarter of an inch in breadth; and the true painful ulcer, independent of syphilitic or gonorrhœal infection, always involves the mucous membrane of the rectum itself. In that form of the disease, to which the term 'fissure of the anus' may well be applied, the affection consists in one or more cracks or streaks of excoriation, or superficial ulceration, situated between the folds of the mucous membrane and integument immediately at the anus itself, involving the rectum but slightly. They produce a considerable amount of uneasiness, smarting, and itching; and, from the periodical action of the anus, the cracks or fissures become deeper and longer, and thus are troublesome to heal. Sometimes excruciating suffering, as is noticed in the true painful ulcer, exists; and on the most scrupulous examination nothing but a long crack or streak of excoriation of the kind mentioned can be seen, and it is reasonable to infer that the cause of suffering is produced by this very slight disorder; it is not difficult to account for it, considering how extremely susceptible some persons—especially females, in whom this condition of the anus is mostly observed—are of painful impressions.

The treatment to be adopted in such cases is, in the first place, to endeavour to procure regular and healthy evacuations of the bowels, and to use scrupulous cleanliness after the motions. A considerable number of persons who suffer from this affection are those who sit a great deal. This should be avoided as much as possible, and plenty of exercise should be taken. The application of the solid nitrate of silver on one or two occasions will sometimes cure the dis-

ease; or a lotion composed of from four to ten grains of the same to an ounce of water may be applied to the part carefully by means of a camel-hair brush every other morning. The ointment of oxide of zinc, or one containing chloroform, will sometimes be equally useful in allaying the irritation and healing the part.

If, however, as will sometimes happen, none of these measures succeed in giving relief, and the patient suffers from continued distress after the evacuation of the bowels, an incision should be made through the fissure; the part will subsequently heal, and the troublesome symptoms disappear.

STRICTURE OF THE RECTUM.

Like other mucous canals, the rectum is liable to a contraction of its cavity; and although this disease may not be considered to be one of very frequent occurrence, it is by no means rarely met with, several cases generally presenting themselves annually at the various public institutions.

The disease consists essentially, in most cases, of an adventitious deposit thrown out upon or around the coats of the intestine. In the most simple form of stricture there is a more prominent ring of apparently hypertrophied mucous membrane, either entirely or only partially surrounding the cavity of the gut. A careful examination on the living body with the finger, and an investigation of the diseased part after death, shows that the thickening is produced in the areolar tissue underneath the mucous membrane; although there are preparations to be met with which lead to the belief that the encroachment upon the cavity of the gut is caused merely by a prominent fold or ring of the mucous membrane itself. In the more marked cases of the disease, not only is the deposit found in the submucous cellular tissue, but there is a thickening of the muscular coat as well, produced, not by hypertrophy of this investment, but by an infiltration of the fibrous exudation through the meshes of the muscular texture. In the more severe cases, where the disease has lasted for a long period, this fibrous deposit becomes more extensive and dense. In most cases there is, together with a very narrow contraction, a large amount of thickening of the coats of the bowel; but every now and then a considerable amount of contraction is found, without any, or with scarcely any, consolidation of the surrounding tissues. In one very interesting preparation in the Museum of St. Bartholomew's Hospital, there is a tight contraction of the gut about three inches from the anus, the cavity being diminished to about one quarter of an inch in diameter for the extent of an inch; but there is not any thickening of the tissues whatever, and the contraction is supposed to be owing to muscular action. In some rare instances, the stricture is caused not by any deposit in the walls of the gut, but by fibrous bands running across the cavity of the bowel; thus, in King's College Museum there is a curious specimen, which shows a stricture about one inch and a half from the anus, consisting of a cup-shaped septum formed of thick bands running across, in which are three or four distinct openings which would each admit a small quill.

In a few instances the fibrous deposit producing the thickening—which is the essential feature of the disease—involves only a portion of the circumference of the bowel, as was found in a case of stricture of the rectum lately brought to me for consultation. In by far the greater number, however, the whole circumference of the gut is implicated in the condensation which has taken place. It may be much more decided on one side than another.

The extent of bowel affected lengthwise also varies much. The disease may involve only one or two lines of the gut; much more frequently the deposit extends from half an inch to an inch and a half in length; sometimes the consolidation implicates three or four inches of the intestine; and, in rare cases, there is a general thickening of the tunics, involving nearly the entire of the rectum, and producing a considerable diminution in the cavity of the bowel.

The pathological changes which occur as the result of stricture of the rectum

affect the bowel in the immediate locality and behind it; important results are also witnessed in the tissues surrounding or in connexion with the bowel.

The intestine immediately above the stricture is, in the majority of cases, more or less dilated; in one instance the cavity being widened only to a small extent, whilst in another, where the stricture has been very tight and of long duration, the intestine is distended in a great degree; thus in one specimen in the Museum of Guy's Hospital, the rectum is five inches in its diameter. There is also a thickening of its tunics above the part immediately diseased, in a great measure owing to an increase in the development of the muscular coat; the law being followed here, that if there be any obstruction to the passage of the contents of a muscular organ, the increased energy necessary will be marked by an increase in the size and strength of the muscular fibres. The mucous membrane above the stricture is generally in a diseased condition, being either preternaturally vascular and thickened, or, in long-standing cases, superficially or deeply ulcerated, and sending forth a copious unhealthy discharge. Below the seat of stricture there is not much alteration of the parts; the mucous membrane is, however, sometimes found to be inflamed and thickened, or even ulcerated; and there may be thickening and induration of the coats of the intestine, the result of inflammation and suppuration extending from the immediate locality of the stricture.

In addition to these morbid phenomena, which are usual, other serious changes are occasionally seen in connexion with stricture of the rectum. Thus the irritation of the disease may produce inflammation and suppuration in the tissues surrounding the bowel; one or more abscesses may form, and communicate not only with the bowel at separate points, but open upon the surface near the anus, or in the front of the perineum. Sometimes a communication exists between the rectum and the vagina or the urethra, and more rarely an aperture forms above the stricture, between the bowel and the cavity of the peritoneum.

The connexion between stricture of the rectum and fistula as one of its results is an important one; the two diseases are by no means unfrequently met with together. It is supposed by some authorities that the fistulous opening in the bowel is generally seated beyond the stricture, and that the morbid change is owing to the obstruction and subsequent mischief produced by the stricture; whilst others, among whom is Mr. Syme, are of opinion that the fistulous opening is not owing to the resistance which is offered by the stricture. It is a fact, however, that the opening is not unfrequently found behind the stricture, and that sometimes it is situated lower down. In a preparation lately inspected by me, where fistulæ were associated with a stricture of the rectum, there was an opening into the bowel above the obstruction, and one situated below the stricture. In another specimen, a fistulous sinus runs up along the side of the gut for half an inch above the stricture. In a patient lately seen by me, where the two diseases were associated, I found, on examination, that the fistulous sinus opened into the bowel just above the stricture. In some of these cases there can be little doubt that ulceration of the mucous membrane is the first step in the formation of fistula; whilst in others suppuration in the surrounding cellular tissue, and subsequent formation of the sinuses, is the correct pathology.

With regard to the seat of stricture of the rectum, it is found that one particular locality is more disposed to the disease than another. Thus in by far the majority of instances the contraction is met with at the lower part of the rectum, about an inch or an inch and a half from the anus. Observation on the living body proves this; and the result of my examination of the morbid preparations in the various museums was to show that, in very nearly one-half of all the specimens, the stricture was found to exist at a point about an inch distant from the orifice. Next in frequency to this part, the disease is met with at a point varying from two to three inches from the anus; it is occasionally met with at four or five inches; and sometimes the contraction involves that part of the gut which marks the junction with the sigmoid flexure of the colon.

The symptoms which are produced by a stricture of the rectum

vary according to the extent and peculiarity of the disease. In some rare cases, even when the obstruction has lasted for years and has materially narrowed the canal, none of the usual symptoms referable to this disease have been experienced until a short period before death, or an examination after death alone has revealed the true nature of the malady. Usually, however, there are well-marked symptoms. In some instances the patient can trace the commencement of his disease to a particular time, when he will inform us he suffered more or less severe and persistent pain in the lower part of the abdomen, which was followed by great irregularity of the bowels, necessitating the use of aperient medicine; diarrhœa has probably supervened, the motions being tinged with blood; and this has been followed by constipation, preventing almost entirely the natural action of the bowels.

As the disease advances, the constipation increases, and there is a sense of obstruction about the rectum, which causes the patient to strain violently whilst at the closet; the fæces are passed in small quantities at a time, and are much diminished in size, as the bowel becomes more contracted; the general health begins to suffer from the retention of fæcal matter in the intestines; the abdomen becomes distended; there is marked dyspepsia, with a loaded tongue and general lassitude; and the patient loses his natural appearance of robustness. The local symptoms also become more severe: there is a continual uneasiness about the rectum; considerable pain attending the passage of the fæces, which is effected two or three times in the twenty-four hours, in a liquid form; the bladder becomes irritable; pain is felt in the loins and down the thighs. Occasionally, a large accumulation of fæcal matter having taken place above the stricture, there will occur suddenly from time to time a violent attack of diarrhœa, followed by the most obstinate constipation. In advanced cases, one very troublesome symptom consists in the excoriation and ulceration which is produced around the anus by the acrid discharge which takes place from the seat of the stricture. In some cases this discharge is very abundant at the time the patient is at the closet, and is one of the most important diagnostic symptoms.

Although the general health in many cases of stricture of the rectum does not suffer much at first, the disease will, if unchecked, destroy life gradually by the local irritation and suffering, and by the impairment to nutrition almost surely following from constant and long-continued obstruction to the passage of excrementitious matters. In other cases the patient dies suddenly, from symptoms

of acute obstruction and inflammation of the bowels, the strictured canal becoming blocked up either by an accumulation of hardened faeces, or by some foreign body. In one remarkably interesting preparation in the Museum of the College of Surgeons, a stricture of the rectum which had existed for years had suddenly become entirely closed, lymph being produced by the irritation of a fish-bone which had been swallowed, and which had become arrested at the contracted part.

When the stricture is situated, as it usually is, within two inches of the anus, it is readily felt by the finger, which should be well oiled and carefully passed, because in many cases great pain is experienced by the patient. When the stricture is but slight, involving a small extent or a portion of the circumference of the bowel, the diagnosis will not be so easy as is imagined; when, however, the stricture, as is for the most part found, has encroached on the cavity of the rectum to some extent, the finger readily detects it; for its point becomes entirely arrested by the dense and hard obstruction, or it can only be just insinuated through the diseased part. When withdrawn, the finger is generally covered with a muco-purulent secretion, if the case is at all advanced.

If the symptoms are well marked, and yet the finger cannot reach the obstructed point, it will be necessary either to make the patient strain violently, or to examine him whilst in the upright posture; in this way a stricture which is situated beyond the reach of the finger in an ordinary examination, may be discovered. Should this fail, a wax or gum elastic bougie, about as large as the adult forefinger, and well oiled, should be carefully introduced up the rectum. This measure, however, is rarely necessary for the mere purposes of diagnosis, and is open to several sources of fallacy.

In making an examination of the rectum, the Surgeon must bear in mind that it may be pressed upon by bodies external to the bowel. An abscess of the prostate gland, especially if of a chronic nature, will so press upon the rectum as to contract its cavity and prevent the passage of the contents of the bowel. Latterly I had a patient at the Westminster General Dispensary, aged 25, who applied with symptoms of obstruction of the bowels; nothing had passed for a week, and he was in continual suffering, and had become very much reduced in health. On examining the rectum with the finger, I found that the cavity of this gut was almost closed by a large elastic tumour situated in front. The patient had not had any gonorrhœa, but about a month since a catheter had been introduced, and had caused severe pain and bleeding. Since then he had complained of pain and weight about the rectum, and the constipated condition of the bowels alluded to had occurred. I suspected that there must be a chronic abscess mechanically preventing the passage of the faeces, and therefore passed a bistoury into the bowel, and made a free incision into the tumour; a large quantity of matter was evacuated, with great relief. The patient was ordered a dose of purgative medicine; this acted freely; and all symptoms of obstruction soon passed away.

The enlarged prostate itself in old people may so press upon the rectum as nearly to obliterate its cavity; the uterus may be retroverted, or a solid tumour growing from this organ may so press on the bowel as to cause the symptoms of

stricture. We have seen that the essential pathological feature in stricture of the rectum is a fibrous deposit in or between the tissues of the bowel; and there can be no doubt that the chief instrument in the formation of this product is inflammation of the coats of the intestine of a more or less chronic character. The causes of the inflammation leading to the formation of stricture are various: spontaneous inflammation of the mucous membrane may arise; or the habitual presence of hard fecal matter, exciting frequent attempts to evacuate, will produce it; foreign bodies lodging in a portion of the rectum for a continuous period will bring about the same result. Muscular contraction may cause stricture. I have alluded to one specimen where this, with very good reason, is supposed to have been the cause. Some of the most severe instances of stricture of the lower part of the rectum, or, more properly speaking, of the anus itself, are produced by the cicatrization resulting from wounds made by the scissors in the removal of external piles, especially if the precaution be not taken to excise only the superabundant textures. Sometimes, in these operations, large portions of skin, as well as circular fringes of mucous membrane, are cut off; the consequence is, the formation of a tight contraction at the anus. I met with an instance of this kind in the person of a lady who had been operated upon for external piles by one who did not understand his business. Such a tight and unyielding contraction occurred as nearly proved fatal; and the only manner in which life could be rendered at all comfortable was by passing a bougie daily, for the patient would not permit me to divide the stricture.

A by no means infrequent cause of stricture of the rectum is ulceration of the mucous membrane of the bowel, terminating in cicatrization and subsequent contraction of the cavity of the intestine. This is occasionally witnessed in those persons who have lived a long time in India, and have suffered from dysentery. Direct injuries to the bowel will produce stricture, such as the operation for fistula, or the infliction of a wound by means of a bougie or an enema-pipe.

There is one cause, however, of stricture of the rectum which is almost entirely overlooked by the majority of writers, in this country at least. I allude to the venereal poison. As a direct consequence of the application of the poison to the part by means of unnatural intercourse, it is doubtless extremely rare in England; but as one of the sequelæ of syphilis, and as one of the indications of constitutional taint, I believe it is not unfrequently met with. Independent of other instances, two well-marked cases of stricture of the rectum occurring in respectable married women, who had suffered severely from constitutional syphilis, have lately been under my care. In either case the disease distinctly ensued after the venereal poison had been received into the system. Mr. Henry Lee has informed me that he has lately seen three cases of secondary syphilitic stricture of the rectum. Mr. Partridge assures me that he had a case in King's College Hospital where there could be no doubt that the disease was produced by unnatural intercourse. Bushe, in his valuable work, says: "Venereal ulceration of the rectum may arise from direct application of the venereal poison; or it may be consecutive to disease in the genital organs, and then co-exists with other secondary symptoms."

The treatment of stricture of the rectum must be conducted upon the same principles as obtain in the employment of remedial measures for stricture of the urethral canal; and in the first place it must be stated that the Surgeon can rarely cure, in the full sense of the word, an organic stricture of the rectum, but he can remedy it in a great measure, prevent its increase, and thus ward off those secondary ills which, almost necessarily, ensue if the original disease be neglected.

The great object the Surgeon has in view is to remove the contraction, and to restore the calibre of the gut as nearly as possible to its natural condition. This can in a great measure be effected by the employment of dilatation in the majority of those cases which are situated within the reach of the finger, and where the primary and secondary morbid changes have not proceeded to a serious state. The agent employed is either the bougie, or some other mechanical contrivance for acting on the stricture as a dilator. The bougie which is most generally used is either made of wax, of gum elastic material, or of metal. As,

in the treatment of strictures of the urethra, various Surgeons prefer particular kinds of dilators, so it is in dealing with stricture of the rectum, although one form of instrument may be as useful as another. The wax bougie is a most admirable instrument in the slighter forms of stricture of the rectum, where much pressure is not required; it is also a good form to employ in cases where considerable pain is experienced on the introduction of the finger, or where, from the existence of much muco-purulent or sanguineous discharge, ulceration of the mucous membrane is suspected. It is important to be very particular in cleaning bougies after use. The gum elastic bougie is the one perhaps which is most generally useful when well made. It is sufficiently firm to compress the stricture well, and yet elastic enough to yield to any obstruction through which it is not intended to pass. The metallic bougie, which is a short cylinder attached at pleasure to a handle, is especially useful in narrow strictures attended with a large amount of induration and situated close to the anus.

Before any attempt is made to dilate a stricture, it is necessary to make a very careful examination, so as to ascertain the exact position and the nature of the stricture. In this manner the Surgeon is enabled to ascertain pretty accurately the size of the bougie which should be employed—a step of importance, as thereby the patient is saved much unnecessary probing, and the bougie is passed into the stricture with more facility. If the point of the index-finger cannot penetrate the obstruction, a bougie smaller in size than this finger should be well oiled and gently passed along to the face of the obstruction. A very slight amount of pressure will generally cause the bougie to penetrate the contraction. If it is held tightly, the instrument should be left for half an hour; if, however, the stricture readily yields, a size larger should be passed.

The effect of this operation must be watched, and if no undue irritation be produced, a bougie of somewhat larger size may be introduced on the second or third day, and be repeated at the same intervals, until as large an instrument as the anus can admit is passed without difficulty. In those instances of stricture where there is but a slight amount of thickening of the coats, the rectum may be dilated almost to its natural calibre in a short period; but when there is great induration of the tissues around, and when the diseased part is exceedingly sensitive, the progress of the case will be slow, and attended with delay and difficulty. The patient may complain of great pain when the bougie is passed through the stricture; and its use may be followed by local and constitutional suffering. If the stricture is very sensitive, the wax bougie should be used, and the size increased very slowly. When the instrument is withdrawn, a suppository of opium should be passed into the gut beyond the stricture if possible; and the patient should sit in a hip-bath, and remain perfectly quiet for some hours afterwards.

By taking these precautions, a case of bad stricture of the rectum, which at first sight would appear to be very refractory to treatment, will be brought into subjection much more readily than is imagined. This will especially be the case in those instances where the patients can remain perfectly quiet. In some cases where the act of dilatation is attended with or followed by much pain, it will be desirable to confine the patient to bed; but in those cases where there is not much suffering produced, this step is by no means necessary.

It is a very important matter, during the treatment in question, to attend to the state of the bowels, and prevent accumulation above the stricture. In fact, it is well, before the use of the bougie is commenced, to clear the intestines out by the exhibition of castor-oil internally, and by the use of injections of warm water; and whilst the dilatation is being carried on, the action of the bowels must be brought into as healthy a condition as possible by the occasional use of these remedial measures.

When the stricture is seated beyond the reach of the finger, the use of the bougie is attended with more difficulty, as there is no certain guide to the exact position of the stricture, or to the size of the instrument which it will admit. With very great care, however, the Surgeon may dilate a stricture when it is situated several inches beyond the anus with safety; but it must be borne in mind, that the folds of the bowel or the prominence of the sacrum

present themselves as obstacles, which may be mistaken for stricture. And the greatest possible care should be taken not to do mischief: it is a well-known fact that in several cases the walls of the gut have been penetrated by the bougie even where there has not been any stricture in existence.

It has been stated that, in certain instances of stricture of the rectum, there has been a venereal origin; and when this can be pretty clearly made out, the local treatment should be assisted by the exhibition of small doses of mercury and iodide of potassium; the general health will be improved, and we may expect a more speedy absorption of the morbid product constituting the stricture. It will be well also, instead of using oil, to smear the bougie with the strong mercurial ointment.

Incision of the strictured portion has been practised by some Surgeons; and, as an adjunct to dilatation, it is, in certain instances, a useful means. It is not, however, free from danger. A case came under my observation a short time since, in which death ensued upon the division of a stricture with the knife, and several similar cases have been recorded. This procedure, therefore, should not be adopted unless there is a necessity for it.

Incision is necessary in those cases of stricture, rarely met with, which are of traumatic origin, and situated at the verge of the anus, or within a very short distance; there is generally a dense cicatrix and much induration around, so that dilatation by the bougie is painful and difficult. It is also advisable, if not actually necessary, in old-standing instances of the disease situated in the usual locality and arising from the usual causes, but where, from neglect and continual irritation, the induration around has become excessive, and the stricture most unyielding to the bougie. In either case the operation is best done by introducing the left forefinger into the rectum, and guiding upon that a straight, blunt-pointed, narrow bistoury, with which the stricture is to be divided. Deep incisions must not be made, but the stricture should be simply notched at several points of its circumference. A bougie should be introduced immediately for a minute or two; a suppository of opium is then to be passed into the rectum; the patient must keep quiet for two or three days, when the bougie is to be employed, and continued at regular intervals. In this manner a stricture, which previously had defied all attempts to dilate it, will be so far reduced that the patient may obtain great comfort.

A stricture of the rectum, when once fully formed, is seldom or never thoroughly cured, even under the most assiduous care. There is the same tendency to re-contraction here as in instances of stricture of the urethra; therefore, when the disease has been brought under subjection, it will be absolutely necessary to keep up periodical dilatation; this may, however, be easily effected in the majority of cases by the patient himself. In some cases once a week will suffice; where, however, the disease has been traumatic, it will be needful to pass a bougie every day, or every other day, to prevent re-contraction.

If sudden obstruction of the bowels should happen to a patient suffering from stricture of the rectum, it will in all probability depend upon some great contraction having occurred, or upon the presence of a foreign body impacted in the strictured portion. A very careful exploration is, therefore, to be made with the finger, when the condition of the parts will be ascertained. Sometimes it will be found that the stricture has become so narrowed that nothing larger than a quill can be passed into it. Under these circumstances it must be cautiously incised, so as to allow of the introduction of an enema-tube, by means of which injections are to be thrown up for the purpose of emptying the bowels. If a plum-stone or some other foreign body is found to be blocking up the contracted orifice, it must be dislodged; and this may be effected either by the introduction of the finger, or by the use of a pair of forceps, which are to be carefully passed through the strictured part.

When sudden obstruction of the bowels takes place in an instance of stricture of the rectum situated high up beyond the reach of the finger, the patient is placed in the most formidable danger, for it is impossible to ascertain the nature of the obstruction. I have referred to one preparation in the Museum of the College of Surgeons, showing a stricture of the rectum situated

near the colon, which had become suddenly closed by an effusion of lymph, the result of a fish-bone sticking in the stricture.

In such cases the long tube must be carefully passed, and the obstruction may be overcome; a large quantity of warm water should then be thrown up. If, however, it is found that the tube cannot be passed, and the use of powerful purgatives is of no avail, death will be imminent; and the only chance of obviating it will consist in making an opening into the colon, either by the method adopted by Littre in the groin, or that suggested by Amussat. The latter operation is that which is usually selected: there are a few cases on record where life has been preserved, and there are instances in which the Surgeon is undoubtedly justified in resorting to this expedient.

CANCER OF THE RECTUM.

In considering the subject of stricture of the rectum, that form of the disease only has been alluded to which is the result of simple inflammatory thickening; there is, however, another condition, where more or less obstruction to the calibre of the bowel is produced by growths which are essentially of a malignant character, whereby the constitution is contaminated, and which render the local disease much more formidable than the simple stricture. The features of distinction between these two particular kinds of the affection are generally pretty broadly marked, and, indeed, cannot well be confounded, when the one we are considering has become fully developed.

Cancer may attack any part of the rectum, but it is perhaps most generally met with in the lower portion; so that in a large number of cases the disease is within the reach of the Surgeon's finger, and its character may be readily appreciated. In the very early stage of the disease it appears to commence as a hard deposit between the coats of the intestine; the deposit in some instances consisting of distinct nodules scattered here and there over the bowel; in other cases there will be a complete circle formed by the disease. The actual seat of the deposit is in most cases the areolar tissue, between the mucous and muscular coat. As the disease advances, this is more distinctly ascertained by the circumstance that the mucous membrane, in a more or less healthy condition, is raised up by the deposit underneath it; in course of time, however, this membrane becomes ulcerated, generally in the centre of the deposit.

In more rare instances the malignant deposit is situated between the muscular and serous coat of the bowel, and the morbid growths penetrate into and between the fibres of the muscular tissue. A general thickening and induration of the whole structure of the bowel takes place, so that when a section is made it is impossible to distinguish one texture from another. By this means the cavity of the bowel becomes encroached upon, much in the same way as when the simple fibrous thickening takes place.

As time advances and the cancerous growth increases, the cavity of the intestine becomes encroached upon to a greater extent by the formation of one or more tumours or nodules, which project into the bowel; by and by ulceration of their surface takes place, and in some instances there will be found blended together a large hard nodule of cancer, and a distinct fungous growth with a bleeding ulcerated surface. The morbid growths increase upwards and downwards, and involve the rectum to the extent of four or six inches, and spread towards the orifice of the bowel, and appear there as warty growths or masses of fungoid disease. It not unfrequently happens, however, that there is a small portion of the bowel perfectly healthy between the anus and the deposit.

The same feature which is associated with malignant disease elsewhere is noticeable here, viz. its power of diffusion and of attacking neighbouring parts; and this is one reason why cancer of the rectum especially is such a distressing malady. On examining specimens of malignant disease of this bowel, which has advanced so far as to terminate life, the surrounding textures and neighbouring organs will be found much affected. In one case the uterus or vagina, in another the bladder, prostate, or urethra, has become involved in this malignant action or subsequent disorganisation. A by no means infrequent result of the mischief in the male is the formation of an artificial opening in the base of the bladder or urethra, and the escape into and blocking up of this canal by faecal matter. In some instances the ulceration penetrates the coats of the bowel, and opens into the cavity of the peritoneum; whilst in others there may be a communication between the bowel and much more distant parts, as for instance the hip-joint. I lately examined a preparation of scirrhus of the rectum, situated about two inches from the orifice; there was a fistulous opening above the stricture, communicating distinctly with an abscess of the hip-joint. In some cases the ulceration which takes place as the result of the extension of the disease is very marked; whilst in other instances there is slight ulceration, but an enormous amount of thickening of the coats and matting together of the various parts around. Sometimes the cavity of the pelvis is found to be almost entirely filled up by a large mass of malignant disease, originating in the bowel. In other cases the peritoneum is thickened with the cancerous matter; the omentum also may be loaded with it, and the liver may have malignant tumours scattered through its texture.

All the different varieties of cancer are seen to involve the rectum; of these, however, the true hard scirrhus is that most frequently met with; next to this, perhaps, the fungoid disease is more often found. Specimens of epithelial and colloid cancer are more rarely, but occasionally, seen.

The symptoms which attend upon malignant disease of the rectum vary much, both according to the stage of the malady and the particular effect the deposit has upon the cavity of the bowel. At the outset the patient complains of an uneasiness about the lower part of the bowel, and an interruption to its proper functions; the faeces passing with more difficulty than heretofore; diarrhoea occasionally intervening, accompanied with bloody mucus, and this latter symptom becomes more and more prominent. Thus at first the symptoms are those which depend upon ordinary stricture of the rectum, and the more especially as in some instances there is very little disturbance of the general health. As the disease advances, however, there comes on a greater difficulty in voiding the faeces, the act is accompanied with considerable pain, and at each time the bowels are moved there is a discharge of blood. As in ordinary stricture, there is great distension felt, which is now and then relieved by a profuse diarrhoea.

The general health at first is but slightly affected; but as the disease advances, its effects on the constitution become marked; the patient complains of indigestion and flatulence, and of an indescribable depression. His face becomes anxious—presents the peculiar dull aspect of one suffering from malignant disease; and emaciation takes place. The patient is deprived of rest; and indeed

there can be few more pitiable objects than some of those who are suffering under cancerous disease of the rectum.

In course of time, the gut becoming more narrowed, and the surface of the diseased textures getting into an ulcerated state, there ensues of necessity a greater hindrance to the passage of the fæces; painful attempts are constantly made to pass them, and these efforts are accompanied with an acrid sanious discharge, mixed with fæculent and muco-purulent fluids. And frequently this action comes on without the patient having the least control over himself. As the disease involves the surrounding tissues, abscess forms by the side of the bowel, and degenerates into fistula. And when the deposit encroaches upon the bladder, there is either great irritability of that organ, or daily retention of urine; this latter symptom may be produced by the impaction of faecal matter in the urethra. I have lately seen a preparation where a fatal retention of urine proceeded from this cause.

Death generally follows this disease within three or four years after its symptoms are marked. And it is produced either by a gradual sinking of the powers of life, or by the sudden coming on of an attack of obstruction of the bowels.

When the disease has existed for some time, and is situated high up the bowel, the Surgeon can have little difficulty in forming a correct diagnosis; but in many cases there is more or less scirrhus induration at the orifice of the anus, or the disease protrudes externally in the shape of a fungoid mass. In the early stages, however, it is not easy to recognise the true nature of the malady. If the growth be within the reach of the finger, it will be felt as an indurated ring, encircling, or partially encircling, the bowel, as when a simple stricture exists; but in the scirrhus disease the hardness is much more decided and more extensive, the discharge also is of a more offensive and sanious character than it is in the earlier stages of the simple stricture. It may, however, be difficult notwithstanding to ascertain the true nature of the malady at its outset; therefore a cautious opinion must be given. I saw, a few months since, a patient, about 40 years old, who was operated upon twice for fistula, neither operation succeeding. On going to see her after the last had failed, I made a careful examination, and discovered a stricture at the lower part of the rectum. I am not aware that there had been any suspicion of malignant disease, and the only reason which made me suspect its existence was the circumstance of the induration being very decided and extensive. I gave a cautious opinion, inclining rather to the view that the disease was malignant. This patient has lately died with cancer of the rectum. I may mention, that the Surgeon who operated upon the fistula was a man of large experience and great skill.

The *treatment* to be adopted for malignant disease of the rectum can offer no other service, unfortunately, than that of palliating the disease, assuaging pain, and prolonging the duration of life. We have seen that, in instances of simple stricture of the rectum, the affection may be cured, or at all events kept under control, by the careful employment of proper surgical means and appliances; because the deposit forming the contraction is merely the result of inflammation, and thus may be absorbed or much diminished by the use of pressure; and moreover, the general constitutional health is not affected as when the disease is of a cancerous nature. Relief, however, can be given to those

unfortunate persons who labour under the latter complaint; and it is important to inquire what are the measures best calculated to produce that relief.

There is a difference of opinion amongst Surgeons as to whether the employment of dilatation is proper. As a rule, it may be stated that bougies should not be used in malignant stricture of the rectum; but it is unwise to discard them entirely. When the disease is met with in its early stage, has not ulcerated, is within reach of the finger, and is producing much contraction of the calibre of the bowel, a wax bougie well oiled may be passed gently through the contracted part; and its use may be repeated once or twice in the week, if pain be not produced. In a case of extensive cancer of the rectum which had not ulcerated, I employed the bougie in this manner for a long period with the effect of giving relief. It is not to be expected that any absorption of the diseased tissue should take place beyond that which is deposited in connexion with cancerous stricture as the mere result of inflammatory action. When, however, the disease has advanced to the ulcerative stage, it would be highly imprudent to use bougies.

The main object in the treatment is the alleviation of pain; and this is best effected by the use of anodynes exhibited in the shape of suppositories made of *pil. saponis comp.* or of morphia mixed with extract of hyoscyamus, in the proportion of half a grain of the salt to ten grains of the extract. This should be introduced each night into the rectum, and in the course of time the strength of the anodynes must be increased. I have seen very great relief given to the patient for many weeks by the use of this suppository. As the disease extends, and involves other parts, the suffering is much more severe, and it will be found necessary to give opium by the mouth as well as by the rectum, in order to produce a mitigation of pain.

The bowels are to be unloaded by the occasional use of aperients, and, when there is not much irritation caused, by the exhibition of enemata of warm water. In order to soothe the ulcerated and painful parts, injections of tepid oil or of decoction of poppies must be used from time to time: the Surgeon must not forget to take great care in the introduction of the enema-tube, as serious mischief may soon be effected.

During the time the malady is running its course, the strength of the patient, which will gradually decline from day to day, must be supported by those articles of diet which contain the most nourishment in the smallest bulk, and which leave but little fæculent matter in the intestines; and it will be needful to avoid as much as possible vegetables and bread. The profuse sanious and foul discharge which sometimes accompanies this disease may be checked by an injection composed of sulphate of copper and opium, or a very diluted solution of chloride of zinc may be employed with benefit.

If sudden and complete obstruction of the bowels should occur during the course of this disease, it will be a question as to how far the Surgeon is justified in making an artificial anus. If this accident happens in the last stage of the disease, when the patient is much exhausted by previous suffering, I do not think that the operation should be performed; but if the obstruction, which must be fatal, should occur during the earlier course of the affection and before the constitution of the patient has been much impaired, the Surgeon is only doing his duty if he recommends a proceeding which, although in itself surrounded with difficulty and danger, may yet prolong life for several months at least, and allow the patient to die at last in comparative ease. Some Surgeons were, a few years since, in the habit of performing excision of the lower part of the rectum when affected with cancer; but this proceeding must be looked upon both as barbarous and unscientific, and it is now, happily, exploded from the catalogue of surgical operations.

POLYPUS OF THE RECTUM.

Polypus of the rectum, although a somewhat rare disease, is not unfrequently seen by those who have large opportunities of

studying the affections of this portion of the intestinal canal. It is met with in various forms, and it is important to be acquainted with the disease, inasmuch as it often produces most severe symptoms, and at the same time is easily remedied.

The most simple form in which a polypus is seen, is where there are one or more short processes, as it were, of the mucous membrane standing out prominent in the cavity of the rectum. These bodies, if they may be so termed, produce little uneasiness, and are generally only accidentally discovered when the Surgeon is making an examination of the bowel with the speculum for some other disease. They are usually situated above the internal sphincter, cause very little inconvenience, and therefore do not demand the attention of the Surgeon.

The soft gelatinous polypus, like that growing from the mucous membrane of the nostril, is very rarely indeed met with; but it is not an infrequent occurrence to observe a polypus which grows from the mucous membrane of the rectum about an inch from the orifice. It varies in length and thickness, being from half an inch to two inches in length, and as thick as a crow-quill or as the little finger. This form of tumour is of a reddish-white colour, firm in texture, and attached to the mucous membrane sometimes by two distinct stalks; or it may have only one attachment and a bifurcated extremity. On examination this form of polypus is found to be fibro-cellular in structure, and very slightly vascular. In one specimen of this fibrous polypus, which I lately removed from the mucous membrane of the gut just within the verge of the anus, some curious microscopical appearances were observed. The structure was principally fibrous, but the mucous covering was arranged so as to form a number of very distinct villous processes. It looked like a piece of small intestine; lacteals could be seen in the villous processes, and their trunks could be followed for some distance into the tissue of which the tumour was composed.

When seated high up, this polypus does not produce much uneasiness; but most generally it is attached to the bowel so near to the anus, that when the patient is at the closet the extremity of the tumour protrudes, and perhaps becomes gripped by the sphincter, and in this manner very annoying and painful symptoms are produced. Sometimes even the polypus protrudes when the patient walks about; great irritation exists; there is a discharge of mucus, sometimes of a little blood; and the patient is obliged to wear a support, which gives ease. He is conscious of some foreign body at the anus, but the symptoms are usually attributed to piles.

The only efficient treatment for this kind of polypus is to remove it; and as there is so little vascularity, it may safely be taken away by the scissors especially when the tumour is very near to the anus; for if there be any hæmorrhage, it is easy to stop it there. When the polypus is situate an inch or more above the anus, and the base is at all broad, the tumour should be well brought down by an injection previously given, and a thread can be tied tightly around the base before the growth is snipped away. In several cases, however, where I have cut these fibrous polypi away without first tying them, there has only been a very slight amount of bleeding subsequently.

A form of polypus very rarely met with is where the growth is warty. I lately saw a gentleman of middle age, who consulted me for prolapsus; and on coming to examine him, after making him protrude the parts well, I found attached to the base of the prolapsed portion, about an inch from the verge of the anus, a curious

looking mass, composed of an aggregation of small lobes arranged upon a peduncle, just like a bunch of grapes. This polypus, if it may be so termed, was an inch in length, of a reddish-white colour, and it protruded at the centre of the anus. I removed this growth; and on microscopical examination its texture was chiefly or entirely epithelial, in fact it might be considered as a warty growth.

The *vascular* polypus is, perhaps, of most frequent occurrence; it is chiefly met with in young children. The tumour varies in size from a cherry to a pea; is of a bright red colour; its structure is fibro-cellular, and eminently vascular. It is either situated within a short distance of the anus, or it may have its attachment one or two inches up the gut, by means of a long narrow stalk. The symptoms which this form of the disease produces is the prolapse of the tumour on the child evacuating the bowels, and hæmorrhage of a more or less profuse character. This bleeding not only takes place when the child is at the closet, but it will persist afterwards, when he is running about. The occurrence of this loss of blood in a child should lead to a close examination of the rectum for polypus; for if the tumour be attached high up, it will recede immediately after the action of the bowels, and escape observation. It is necessary, therefore, to make the inspection immediately after the evacuation of the contents of the rectum either by medicine or an enema.*

The treatment which should be adopted is simple, and merely consists in the removal of the polypus, either by twisting it off with a pair of forceps, or placing a ligature around the pedicle, and returning the tumour within the bowel and allowing it to slough off. Excision should not be resorted to in these cases, as there might be a considerable amount of bleeding, which would be especially prejudicial in a young child.

A rare form of polypus of the rectum is occasionally met with in adults,

* It is very important to make a thorough examination of the rectum immediately after the bowels have acted upon, when there is a suspicion of a polypus, otherwise the disease may escape notice. A remarkable illustration of this occurred in a lady to whom I was called by a medical practitioner, who had been in constant attendance upon the patient, whose symptoms were referred to some external piles. These were removed, but with scarcely any relief to the severe pain experienced after the action of the bowels, and to the sense of protrusion. I made a careful examination, after the bowels had been well cleared with an enema; but nothing was observable beyond a slight crack at the posterior part of the anus. It was thought right to divide this, in the hope that the severe pain would be removed by the operation, but this failed in its object; and we were vainly endeavouring to ascertain the cause of her suffering, until on one occasion we found the patient had just got into bed after having had the bowels freely acted upon. I took the opportunity of examining her immediately, and to my great surprise found a large fleshy polypus attached high up to the posterior wall of the gut by a narrow peduncle. Without further delay, I with some difficulty placed a double ligature around this tumour, and thus fortunately removed a disease which, from being long undetected, had caused great suffering. It was strange that this polypus had not shown itself when I examined her on a previous occasion, after the action of the enema.

when the tumour reaches a size as large as an egg; it has been not inaptly termed the *villous* tumour, inasmuch as it mainly consists of elongated processes or villi, extremely vascular. This form of tumour produces most severe symptoms of a foreign body in the bowel, and is the cause of periodical hæmorrhage to a large extent, by which the health becomes very much broken down. It is a question with some as to whether this form of polypus is malignant or not.

Mr. Quain has made some investigations into the structure of this tumour, and he has found that it was composed of long processes slightly held together, each process strictly resembling villi. And as the mass is very vascular, he has concluded that the disease is not of a malignant nature, as stated by Rokitsansky.

A very interesting specimen of this rare form of tumour of the rectum is preserved in the Museum of St. George's Hospital, and on examination it presents exactly the features described by Mr. Quain. It was situated about three inches from the verge of the anus, in the anterior wall of the rectum, evidently springing from the submucous cellular tissue. It is round in form, circumscribed and prominent, and about the size of an orange. The tufts or processes are remarkably well developed. The tumour so obstructed the cavity of the bowel, that almost complete retention of the fæces resulted, and the gut above was very much distended. The bladder was much pressed upon by the diseased mass. It was impossible to say how long the disease had been growing, but it was not detected until about five years before death, when the occurrence of hæmorrhage and of the symptoms before spoken of led to its discovery. Several attempts were made to destroy the mass by ligature and other means, but it was not possible to effect more than a partial removal of the more prominent portions,—an operation which was performed no less than thirty-three times before his death, and on each occasion with temporary benefit. The patient was 70 when he died, and no other disease was found in a careful examination of the body.*

PRURITUS ANI.

This affection is very common, and very productive of suffering; and although certain pathological changes occur at the margin of the anus in connexion with it, itching and irritation of this part must be regarded rather as a symptom than as a special disorder. Thus it is frequently associated with an unhealthy state of the secretions of the intestinal canal, or with simple constipation; a fact which is not uncommonly overlooked in the treatment of those who suffer; it is also attendant upon a congested state of the vessels of the rectum, which can hardly be considered hæmorrhoidal, inasmuch as on examination there will be found neither hæmorrhoidal tumours nor prolapsus, but a considerable amount of congestion of the mucous membrane. This form of the complaint is peculiarly prone to occur in those who sit for a long time together at the desk. Pruritus is familiar to us as a symptom of ascarides in the rectum; it is also found in a very distressing degree in connexion with disordered conditions of the womb. I have recently seen a case of ulcer of the rectum, where the only well-marked symptom attending upon

* *Path. Soc. Trans.* xii. 120.

this usually painful morbid condition was a constant and troublesome itching.

Certain morbid changes occur around the margin of the anus in advanced cases of this disorder, in consequence of the attempts of the patients to relieve themselves by scratching and irritating the parts; the naturally thin skin becomes excoriated; the secretions of the part are exaggerated; and if the irritation is continued, fissures, and even ulcerations, are formed; and in course of time the integument becomes thickened and indurated, and gets almost into a condylomatous state; and a painful and distressing itching is produced—especially when the patient lies down in bed—which is most troublesome to remove.

The treatment to be adopted in such cases is to be conducted upon the ordinary principles of surgery. In the first place a very careful examination of the parts must be instituted, both external and internal; and strict inquiry should be made with a view of ascertaining if there be any special cause for the existence of the pruritus, such as ascarides or a loaded state of the large intestines; in either case the exhibition of purgatives and the use of enemata will be the proper plan of treatment, and immediate relief ensues. If dyspepsia, together with an unhealthy secretion, exist, strict avoidance of improper articles of diet, and the occasional use of a pill composed of a grain of calomel and three or four of watery extract of aloes, will frequently remove the itching of the anus, without the employment of any local measure beyond the application of water or soap and water. It is, however, in those cases where the disease, although perhaps at first only a symptom, has, by neglect and irritation, degenerated more decidedly into a local malady, that great difficulty is experienced in procuring relief. Here, at the same time that constitutional measures are not neglected, local remedies will be mostly required; but very often many will be tried, one after the other, before the desired relief can be obtained. In these cases there will be generally found some morbid alteration, in the form of slight ulcerations or fissures of the skin, and the first object is to heal these; and it may be effected by the very careful application of a solution of nitrate of silver—of a strength varying from ten to twenty grains of the salt to an ounce of water—by means of a camel's-hair brush. This application should be repeated so long as the cracks or ulcerations exist. Not unfrequently the itching and irritation will disappear so soon as these heal and the skin becomes healthy; but there is a tendency for the excoriations to reappear; and to prevent this, the patient should be advised to bathe the parts well morning and night with a strong solution of alum. If the solution of nitrate of silver fails either to heal the fissures, or to give relief to the itching when they are healed, an ointment composed of one drachm of glycerine to an ounce of lard may be used with good effect; and should there exist a thickened or condylomatous condition of the integument, I know of nothing more useful than the application of an ointment composed of one drachm of calomel and one ounce of lard. If an ulcer—as in the case mentioned before by me—should be found to exist within or upon the phincter, the ordinary operation for that malady must be put in force.

In some obstinate cases, it will be found that the use of all the usual measures, general and local, will be unattended with relief. If it has not already been tried, I am in the habit of recommending the daily introduction of a well-oiled bougie made of black wax.

NEURALGIA OF THE RECTUM.

It is perhaps impossible to affirm with truth that neuralgia, as it attacks other parts of the body, is ever situated in the rectum; but every now and then cases are met with where extreme suffering of a distinctly neuralgic character is experienced for a long period, and where, on the most careful examination of the parts, both external and internal, no appreciable lesion can be found; and we therefore do not hesitate to apply the term neuralgia to this condition of things. The cases are more frequently met with in the persons of females who have been lowered by some depressing causes; the pain is described as being very severe and continuous, and not particularly aggravated by the action of the bowels, as is the case when the suffering is produced by a painful ulcer of the rectum. It may be of a marked periodical character, and be the result of direct exposure to cold.

The cure of this affection is extremely difficult, and indeed sometimes only a temporary relief can be given. Of course, when a patient applies with the symptoms of neuralgia, the most careful examination of the parts should be instituted, and repeated from time to time; for doubtless in some of those cases which have been supposed to be neuralgia, there has been some lesion which has been overlooked. If, however, nothing of the kind can be met with, a similar treatment to that which is put in force for neuralgia in other parts should be adopted, due regard of course being had to the removal of any local irritant from the bowels in the shape of hardened fæces: iron and quinine in large doses should be exhibited, especially in those cases where there has been any lowering of the system; should there be any tendency to gout—a point not to be overlooked in our inquiries—colchicum should be prescribed. The local remedies best suited for this complaint are, the employment of the cold douche to the anus, and the use of belladonna ointment, in the proportions of one drachm of the extract to one ounce of lard, either smeared around the anus, or introduced up the rectum by means of a large wax bougie. Should the latter measure be adopted, care should be taken to watch the effects of the belladonna on the system.

HENRY SMITH.

HERNIA.

PART I.

PATHOLOGY AND TREATMENT OF HERNIA IN GENERAL.

AN escape of any viscus from the cavity in which it is naturally placed is termed a hernia; but the observations in this essay are exclusively restricted to protrusions of the abdominal viscera. In common language this disease is called rupture. Our object will therefore be to describe the varieties of hernia developed in the different regions of the abdomen, their pathology and treatment.

The whole subject is divided into two parts.

The first embraces general considerations in relation to the statistics, pathology, and treatment of the disease.

The second is devoted to an examination of the special regional varieties of hernia, their anatomical characteristics, etiology, diagnosis, prognosis, and the treatment especially adapted to each kind.

Sex. Both sexes are afflicted with hernial protrusions. After carefully considering the statements of writers in relation to the numerical proportion in which the two sexes are subject to hernia, we must admit that we have not the requisite data to enable us to arrive at any satisfactory conclusion. We may, however, broadly state the fact, that hernia occurs more frequently in males than females. Out of a gross total of 96,886 applicants for trusses at the City-of-London Truss-Society, the males were 78,394, the females 18,492. After a careful consideration of all the circumstances, Mr. Kingdon estimates the proportion at two males to one female, for all ages and including every variety of hernia.*

Frequency of hernia at different ages. The only trustworthy facts relating to the various ages at which hernial protrusions are first developed, have been collected by Mr. Kingdon. In the reports of the City-of-London Truss-Society for the years 1860 and 1861, he has tabulated 9296 cases of inguinal and femoral hernia. All these patients passed under his personal examination, and the respective age of each individual when the hernia developed itself was ascertained as accurately as possible, by reckoning back to the age at which it was first noticed. Observers have been before this occupied in attempts to ascertain the ages when protrusions most frequently occur; but they have uniformly noted the ages of the persons at the time of their appearance before them. Accurate data were, under these conditions, never obtained; that is, if a knowledge of the age at which hernia is developed is to be regarded as a desideratum. Hence M. Malgaigne makes it appear that there are fewer cases of hernia before thirty-five years of age than after. This is

* The proportion between males and females varies considerably at different periods of life, on account of causes connected with certain congenital malformations, which will be spoken of in treating of the special forms of hernia. Thus, in Mr. Kingdon's statistics for 1860 and 1861, there were in the first five years of life 1409 males, and only 107 females; while in the five years from 25 to 30 years of age, the proportion had changed to 846 males against 207 females.

a fundamental error, unless national peculiarities produce different results. The truth is, taking all varieties of hernia in both sexes, that the majority of cases are developed before thirty-five years of age.* I believe in the correctness of this fact, after having tested its accuracy as far as my means allow. It is, I know, directly in opposition to the received dogmas; but as we advance we shall be able to assign very good reasons why hernia is so much more common before middle life than after that period.

TABLE A.

Showing the ages of the patients when the hernia was first noticed.

Age.	1860.				1861.				Kingdon's Tables—Report of Truss Society, 1861-62. Age at development.
	Inguinal.		Femoral.		Inguinal.		Femoral.		
	M.	F.	M.	F.	M.	F.	M.	F.	
under 1 yr.	473	27			563	37			1100
1 to 5	181	17			192	26			416
6 „ 10	91	23	3	1	112	16	2		248
11 „ 15	115	19	4	2	133	19	3	6	301
16 „ 20	284	27	3	14	291	38	8	15	680
21 „ 25	348	30	18	31	375	33	13	37	885
26 „ 30	381	45	21	58	424	50	20	54	1053
31 „ 35	334	48	19	55	399	37	14	70	976
36 „ 40	320	38	18	59	373	41	16	68	933
41 „ 45	271	31	30	47	268	24	11	49	731
46 „ 50	258	11	18	32	272	10	15	30	646
51 „ 55	167	12	12	26	224	11	11	27	490
56 „ 60	147	6	9	16	151	4	8	15	356
61 „ 65	97	6	10	11	110	3	7	12	256
66 „ 70	59	5	8	2	44	1	1	3	123
71 „ 95	32	1	1	1	54	3	3	7	102
	3558	346	174	355	3985	353	132	393	9296

Frequency of hernia in relation to population. We have no trustworthy data on this subject. The general statements which have been advanced, in some of which the proportion is put as high as one in eight of the male inhabitants of the whole kingdom, and even one in five of the whole population of one district, do not rest on any precise information, and appear exaggerated.

Frequency of hernia in relation to age. Mr. Kingdon's statistics (Table A) show that out of 9296 applicants for trusses, 1516 were under 5 years of age. This would appear at first sight to show a much greater prevalence of hernia in infancy than during any other period of life. But this disproportion vanishes when we take into consideration the number of infants out of any given population. Thus, if we take Mr. Kingdon's table as giving an accu-

* The following statements show the number of cases of hernia occurring at different ages, when the age of each patient was recorded by M. Malgaigne, at the time each one came under his observation; and when the respective ages were carefully ascertained by Mr. Kingdon, to show when the hernia was first noticed. Out of 2343 cases recorded by M. Malgaigne (*L'Union Médicale*, 1854, p. 53), 555, or 23·6 per cent, were under 35 years of age; 1788, or 76·4 per cent, above that age. On the contrary, out of 9296 cases recorded by Mr. Kingdon, 5659, or 60·8 per cent, had commenced before 35 years of age; and 3637, or 39·2 per cent, after that age.

As the two tables exhibit such different results, I wrote to M. Malgaigne, who kindly returned the following polite reply:

“Mon cher confrère; La réponse à votre question:—les âges marquées à la page 53 (de *L'Union Méd.* vol. viii., 1854) sont ceux des malades au moment où ils venaient à la visite du bureau central.”

rate idea of the numerical prevalence of hernia at different ages in London, we must compare the ratio between the number of cases of hernia at any given age and the total number of cases of hernia, with the ratio between the number of the population living at that age and the total population. Proceeding in this manner, we shall find that while there is no exact proportion maintained, yet the frequency of hernia slightly advances towards the latter end of life. Thus, taking the census of 1851, the total population of London of both sexes at all ages was 2,362,236; out of these, 293,562 were under 5 years of age: a ratio of 1 to 8·004. Out of the 9296 which form Mr. Kingdon's total, 1516 were under 5 years of age,—a ratio of 1 to 6·13. Taking the next decade, we find the total number of the population between 5 and 10 to be 243,648, or in a ratio of 1 to 9·69 to the total population; the number of cases of hernia, however, is only 248, or in the ratio of 1 to 37·08 to the total number of cases of hernia. Again, it was shown above that the absolute number of cases of hernia developed under 35 years of age was greater than that of those developed above that age, the proportion in Mr. Kingdon's table being 61 to 39. But in the census-table the proportion of persons alive under 35 to those above that age is still higher, viz. 69 to 31. Therefore hernia is more common relatively to the number of the population above the age of 35 than under that age. It appears from calculation on these data, that 41 per cent of cases of hernia are developed under, and 59 per cent over, the age of 35.

The relative proportions of the different kinds of hernia at various ages and in both sexes, together with explanations of their occurrence, based upon anatomical and physiological facts, will be found in other parts of this essay.

The influence of occupations on the formation of hernia. All persons, in every station of life, are liable to hernia. By far the majority of cases occur among the labouring class, which, abounding as it does in all large towns, affords a favourable opportunity to ascertain whether the pursuit of any particular trade or occupation involves a greater liability to hernia than another.

Mr. Kingdon has inquired into this subject with his usual care, and the results of the investigation are printed in the Report of the City-of-London Truss-Society.* He has produced a table in order to compare the twenty-five largest classes of occupation, arranged in the order of their magnitude from the census of 1851, with the numbers of each class who applied to the Society during three successive years. This "indicates that the patients who seek relief on account of hernia bear a direct proportion to the numerical magnitude of the classes to which they respectively belong, and not to the severity of the toil."

The influence of hereditary conformation predisposing to the development of hernia. A disposition to hernia may be inherited; that is, the children of ruptured parents are frequently afflicted in like manner. Mr. Kingdon has taken great pains to ascertain the proportion of cases in which this hereditary influence exists. In the reports of the City-of-London Truss-Society for 1860-61, he has published the result of his inquiries. Both sexes show an equal tendency to be thus influenced. The proportion, by calculation, seems to be about 34 per cent. This hereditary predisposition, paternal, maternal, or on both sides, is manifested in the most marked degree with infants under one year; the cases being about 12 per cent of the whole number in the first twelve months of life.

This fact points to two very important causes which give rise to hernial protrusions at this early age: first, to the arrested efforts of nature in closing the ventral orifice of the vaginal process of the peritoneum, and the obliteration of that sheath; and secondly, to an abnormal elongation of the mesentery. Those two structural conditions belong to a class of anomalies very likely to be determined by hereditary influences.

* Report, 1861, p. 11.

Congenital defects of the parietes of the abdomen have been already mentioned as predisposing causes of hernia, and this subject will be further dwelt upon in discussing its various forms. Wounds or inflammatory lesions of the abdominal walls may also predispose to hernia; but other predisposing causes may be mentioned. It may be made a question, whether a portion of small intestine can reach the fundus of the scrotum, unless its mesenteric ligament be of preternatural length. For it is difficult to understand how the upper portion of the small intestines or the cæcum can descend so low as they are sometimes seen, without at the same time their mesenteric folds being elongated. But the fact to be accurately ascertained is, whether the mesentery is abnormally long antecedent to the descent of the hernia; whether, in truth, a morbid elongation of the mesentery be a primary cause of hernia or not. Doubtless this structure becomes lengthened and stretched as the result of repeated or continued descents of the intestine; but we are not cognisant of any facts to prove a congenital condition of the kind above alluded to. At first sight, this circumstance regarding the elongation of the mesentery may seem to have very slight practical value. Upon reflection, however, we shall arrive at an opposite conclusion. It has a very important bearing on the question of the radical cure of hernia, as it is termed. For if it be proved that the primary cause of any viscus protruding from the abdominal cavity can be traced to a morbid condition of its peritoneal retaining ligaments, the mere obliteration of the hernial sac can avail but little in producing the intended result of affording permanent immunity from the disease. That which often happens when a truss is used to support one kind of hernia would occur in this case also, namely, the development of another, perhaps even on the opposite side of the body; and thus any operation, even if successful in obliterating the first sac, would be of little value.

Persons in whom a hernial sac exists certainly state, that they are more troubled with the descent of a hernia if they get out of health. This circumstance leads to the inference, that when the tissues generally are weakened and relaxed by indisposition, those which should maintain the viscus in its proper situation, participate in the general morbid condition, and then permit the hernia to escape more readily.

It is equally certain, too, that persons constitutionally of a weak frame of body, whose contractile and fibrous tissues are deficient in tone and power, become more commonly subject to the development of a hernial sac as age advances, than those of an opposite conformation; always, of course, excepting those persons who have a congenitally open vaginal process of the peritoneum.

And further we may state, as the result of actual observation, that in both males and females of middle age the subject of hernia, the heavy abdominal viscera, the solid glands for example, are usually disposed in a much lower situation than their normal one; that, in fact, the abdominal viscera generally are not so firmly held in their proper places by their peritoneal ligaments as when no disposition to hernia is shown.

Between the muscular walls of the abdomen and the contents of that cavity a constant antagonism exists. The gaseous and fluid distension of the intestinal tube exerts an ever-variable pressure against the abdominal walls, whilst they, in their turn, react upon the inflated viscera: thus between these opposing forces a sort of equilibrium is maintained. The balance between them is, however, sometimes destroyed, and the parietes are no longer able to restrain the viscera within their normal limits. Thus hernia is often associated with a great increase in the bulk of the viscera, from the rapid development of fat in the omentum and mesentery. A persistent laxity of the parietal peritoneum likewise, subsequent to distension of that membrane, occasioned by the gravid uterus, is a morbid condition which renders it liable to pass readily out of the abdomen, under the influence of any pressure from within, through the weak points of the walls, and it must also be reckoned among the predisposing causes of hernia.

The immediate cause of a hernia is certainly, in some cases, to be traced to a sudden and forcible diminution in the capacity of the abdominal cavity, the result of compression or contraction of its walls: in other words, the combined actions of the abdominal muscles, coincident with strained attitudes and postures of the body during the effort of violent muscular exertion generally, give rise to the sudden development of a hernia. We cannot, perhaps, accept as truth the statement of all the ruptured men who attribute their affliction to muscular exertion; but all Surgeons who have had much hospital experience will be able to call to mind cases depending upon this cause.

A large proportion of the cases of hernia are undoubtedly of gradual development. In many of these, however, violent muscular contraction doubtless plays an active part. How often we observe hernial tumours in patients afflicted with dysuria! Is not hernia very liable to occur in persons labouring under bronchitis of one form or another? And although it must be admitted that more or less laxity and loss of restraining power in the tissues of these persons exist with regard both to the fibrous walls of the abdomen and the peritoneal ligaments of the viscera, yet this effective agent, muscular contraction, exerts its powers with less restraint and limit, and thus presses the viscera away from their normal situation.

The hernia consists of a part only of any of the abdominal viscera. Such of them as are permitted, by their peritoneal attachments, to change their relative situation within the abdominal cavity with the greatest freedom, most frequently escape or protrude through its walls. Thus portions of the small intestines and omentum form the contents of the hernial sac in the majority of cases, although a part of every abdominal viscus has been occasionally found therein.

Semeiology. The signs which denote a rupture are more or less marked according to its volume, its condition, the viscus composing it, and the thickness of the tissues by which it is covered. The patient complains of "a weakness" in the region in which a hernia commonly occurs; and this is often the first symptom which indicates a tendency to a protrusion in the adult. The inguinal region, especially in a male adult who makes a complaint of this kind, shows a remarkable fulness at the site of the internal abdominal ring, and often along the whole track of the region of the abdominal walls termed the inguinal canal, if carefully examined. From a similar appearance, a tendency to hernia may be detected in the weakly and delicate adult female at the crural aperture. In both cases the fulness becomes much more distinct if the patient maintains the erect posture and forcibly contracts the abdominal muscles.

Next, a small swelling or "lump" is felt, which is not permanent, but disappears under slight pressure or on assuming the recumbent posture, and reappears when the pressure is removed or on standing upright, and which becomes more prominent when the abdominal muscles are put into strong action by coughing or some voluntary movement.

In infants and children the tumour produced by a hernia is often of considerable size when noticed for the first time; but it soon diminishes if the swelling be pressed, or the recumbent posture imposed. In youthful adults also a hernia is often developed suddenly, generally in the inguinal region or scrotum. This, happening under the influence of violent muscular exertion or forcible compression of the abdominal walls, is usually attended with more or less pain.*

The structure of the viscus which forms the hernia also modifies its signs and indications: thus, if the protrusion be solid, as when omentum escapes (epiplocele), the hernial swelling will be hard, resisting, and lobulated; if the protrusion be hollow, as in hernia of intestine (enterocele), the swelling will be yielding, soft, elastic, and if the contents be gaseous and fluid, it will yield a dull sound on gentle percussion, or a peculiar gurgling is heard at the time the rupture is handled.

Some swellings formed in those regions where hernial protrusions commonly occur closely resemble that disease; but as they are liable to simulate some special kind of hernia, their differential diagnosis is given in other parts of this essay.

Prognosis. By the use of ordinary care and precaution, a person the subject of hernia is not in great danger of those accidents affecting it which imperil life. On the contrary, however, by neglecting to employ a bandage to prevent the escape of the hernia, or by making use of an instrument which fails to effect the purpose intended, namely, the complete retention of the hernia within the abdomen, the life of the individual is perpetually in jeopardy from the liability to inflammation or strangulation of the protruded viscus.

In proportion, then, as the palliative measures directed by the Surgeon are carefully executed by the patient, the prognosis in any case of reducible hernia may be regarded as favourable, or the reverse.

If the hernia be a small reducible enterocele, a truss may be used, which will prevent its descent for months, or even years. If the case be one of irreducible epiplocele, complicated with the occasional descent of small intestine, the prognosis must be regarded as relatively unfavourable, in consequence of the great difficulty in

* In a manuscript lent to me by Mr. Kingdon, he shows that, out of 706 adult males, only 48 pretended to assign any cause for the protrusion; but I find that the majority of the men in whom the inguinal hernia was suddenly developed were youthful adults.

preventing the entrance of the bowel at the orifice of the sac, where it may become strangulated without any premonitory symptoms.

Nomenclature of herniæ. The varieties of abdominal herniæ are named from the period of life at which the hernial sac is formed; the region in which the protrusion takes place or exists; as well as from the viscus which composes the tumour.

When named from the viscus forming the protrusion, a hernia is styled intestinal when any portion of the alimentary canal escapes. This is also termed an enterocele.

If a portion of omentum protrude, the expression omental hernia, or epiplocele, signifies its nature.

A combination of these two is called an entero-epiplocele.

The terms gastrocele, cystocele, have been applied to protrusions of the stomach or bladder from the abdomen.

The classification of hernia according to the regions in which it occurs will be found given in the second part of this essay.

The essential parts of a hernial tumour. When an anatomist dissects a tumour caused by the protrusion or escape of any viscus from the cavity or region in which it is naturally contained, his observation should be especially directed to three principal objects. These are:

1. *The tissues outside the sac*, or the ordinary structures of the region in which the hernia is developed;
2. *The sac*; containing
3. *The hernia itself*, or the protruded viscera.

Under these three sections we shall describe the essential elements of a hernial tumour: first, in the condition in which they commonly exist, when the only source of trouble depends upon the mere tendency to the protrusion of the hernia; and secondly, under those morbid conditions which affect certain parts of the sac; the contents of the sac, the real hernia; and the tissues outside the sac. Upon the judicious surgical treatment of these morbid conditions the salvation of life depends.

The inciting causes of hernia. Protrusions of the abdominal viscera are the result of—

1. Wounds or lacerations of the abdominal walls;
2. The weakening or destruction of the same parts by inflammatory processes;
3. The existence at birth, and persistence afterwards, of a canal which is a prolongation of the peritoneum; and,

4. The slow and gradual extension of the parietal peritoneal membrane of the abdomen out of that cavity, forming a pouch or receptacle for the extruded viscus.

1. In this essay I am not required to describe those of the first class, which depend on wounds, such cases having been treated of under the head of INJURIES OF THE ABDOMEN (vol. ii. p. 431).

Hernia, however, occasionally occurs in the inguinal region, as the result of the application of direct violence in its vicinity, without a wound.

2. The weakening or destruction of the abdominal parietes from the effects of inflammation and its results give rise to the secondary occurrence of hernia. Thus, after the healing of abscesses in those parts, it is not very uncommon to see a hernial tumour developed at the site of the primary disease. It is important, therefore, as a prophylactic measure, to support the abdominal region by means of a suitable bandage during the healing of such abscesses, and for some time after cicatrization.

3. *Congenital patency of the vaginal process of the peritoneum.* We must now consider that congenital condition of the peritoneum which allows a portion of the abdominal viscera to escape from its natural cavity and occupy an abnormal position in its immediate vicinity.

Towards the close of the last century, and at the commencement of this one, anatomists were very much interested in observing the changes in the situation of the testicles during the period of foetal life. Accurate observation established the fact, that the development of the testicles commenced in the lumbar regions of the foetus in utero, and that when those organs had reached a certain stage of perfection, they migrated from their primary locality, and, pursuing a course towards the pelvis, they at last reached the scrotum, the final point of their destination. In this progress, termed the "descent of the testicles" and whilst they are within the abdomen, they are placed behind the peritoneum, and partially invested by it. A prolongation from this serous membrane accompanies them into the scrotum, and receives the name of the vaginal process of the peritoneum.

Thus wrote Wrisberg in the year 1800: "*Testis semel in scrotum delapsus pluribus cingitur velamentis. Tria esse membranarum genera, quæ id præstant. Tunica vaginalis communis pro teste, epididymide et funiculo spermatico simul; Tunica vaginalis propria vasorum spermaticorum; et Tunica vaginalis similiter testis et epididymidi propria; cuilibet in arte anatomica tironi nunc cognitum est.*"*

A direct and uninterrupted communication exists between the cavity of the peritoneum and the interior of this sheath; so perfect, indeed, that the more movable abdominal viscera can pass, without impediment, from the one into the other. The line of demarcation between these cavities corre-

* H. A. Wrisbergii *Commentationum Med. &c. Soc. Reg. Scient. Göttingensi oblatarum et editarum*, vol. i. p. 179, § 5.

sponds to, or is in relation with, that arrangement of the internal abdominal fascia termed the internal inguinal ring; and, adherent to the posterior surface of the vaginal process, near its inferior termination, is placed the testicle.

In early foetal life, and, in many instances, for a month or even a longer period after birth, this tubular process of the peritoneum extends into the scrotum. It lies in front of the spermatic cord and testicle; extends from the internal inguinal ring to the lowest end of that gland; and forms a membranous, cylindrical canal until it reaches the testis, when it expands into an elliptical cul-de-sac. Before birth, or soon after, this vaginal process of the peritoneum is divided into two portions—a superior and inferior. The sheath contracts near the head of the epididymis, its surfaces adhere firmly at that spot, and thus two cavities are formed. The inferior one is termed the tunica vaginalis propria testis; for it is in immediate relation with a large portion of the surface of the testicle. The superior canal, termed the tunica vaginalis propria funiculi, lies in front of the spermatic cord.

When these parts are in a normal condition, the inferior cavity or vaginal covering peculiar to the testis remains throughout life as a closed serous sac, and contains a little serum. Under similar conditions the superior canal or vaginal covering peculiar to the spermatic cord is entirely obliterated. Its superior abdominal or ventral orifice is permanently closed; and although a trace of the existence of this canal is sometimes observable in adult life, it is merely a delicate fibrous cord, the *ruinæ processus vaginalis peritonei*. Occasionally, although very rarely, a fine membranous canal remains throughout a long life sufficiently large to admit an ordinary-sized probe. In the account of the post-mortem examination of Sir Astley Cooper, it is stated that “a minute serous canal, not more than a line in breadth when opened, was traced, extending from” a depression at the right internal abdominal ring “along the spermatic cord, into the cavity of the tunica vaginalis.”*

Sir Astley Cooper himself writes: “I dissected a boy, 6 years of age, in whom the opening of the tunica vaginalis (vaginal process of the peritoneum) was still so large that I could pass a female catheter through it down to the testis.” And further on, in the same chapter, he relates a case of “sudden descent of a hernia into a congenital vaginal process of the peritoneum, of the nature above described, in the person of a young man whilst in the act of lifting a sugar-cask.”† Several instances of a similar kind have come under the observation of the author of this essay.

Of the changes which take place in the vaginal process of the peritoneum. Several distinguished anatomists have traced the changes which occur in this serous sheath to render perfect its obliteration. Without producing a literal translation of the writings of Seiler, I believe it will be interesting as well as useful to the reader to quote the substance of his observations.‡

When the testis has reached the bottom of the scrotum, the inguinal canal, along which the cord passes, is still very short, scarcely one and a half to two lines long. In the fourth and fifth month the internal inguinal ring lies almost directly behind the external. The inguinal canal is developed in the later months, and soon after birth it is always longer. The spermatic cord now consists of the blood-vessels, vas deferens, nerves, and the vaginal canal, at the termination of which lies the testis and the larger part of the epididymis.

After the testicle has reached the fundus of the scrotum, the obliteration of the vaginal canal proceeds from the inguinal rings downwards to the superior border of the testis, so that only the proper vaginal membrane of

* *Guy's Hosp. Reports*, 1841, vol. vi. p. 232.

† *The Anat. and Surg. Treatment of Abdom. Hernia*, 2d edit. chap. xvii.

‡ Anton. Scarpa's *Neue Abhandlungen ü. d. Schenkel u. Mittelfleischbrüche*, &c. bearbeitet mit einer Anleitung zu der Zergliederung d. Leistengegend, &c., mit Kupfertafeln, von B. W. Seiler, vol. ii. p. 374, &c. Leipzig, 1822.

the testis remains, as a rudiment of the vaginal canal—the tunica vaginalis propria testis. The time at which the closure of its ventral orifice takes place and the obliteration of the canal is completed cannot be well defined. It is usually closed, at least on one side, and generally at the upper part, from the internal inguinal ring to the centre or middle of the spermatic cord, even before the whole vaginal canal has contracted, especially that portion which is embraced by the internal inguinal ring. The first stage of the obliteration of this canal commences with this process.

In the second stage, the walls of the vaginal sheath unite together entirely, as far as the superior end of the testis; or it first closes in the neighbourhood of the testis, so that the centre part still remains open.

The third stage is accomplished when the canal is partially or entirely closed. This portion of serous membrane is converted into a flat band, which afterwards becomes connective tissue, but which is rather closer and finer than the rest of the same tissue of the spermatic cord.

As the fourth stage, this stripe of connective tissue always becomes thinner, and at last entirely disappears; or there remains behind only a slight trace of it below, above, or in the centre.

State of the vaginal process of the peritoneum at birth. In the majority of new-born infants some portion of the vaginal canal still remains. In 21 Seiler found 4 in which it was open on both sides; 5 in which it was open on the right side; 4 on the left; and of these 13, 5 in which the abdominal aperture continued open on either one or the other side. In 5 of the 21 infants the canal was closed above and below, but in the centre open; in 3 the inferior part was closed, but in the upper part, from the internal abdominal ring, a portion remained wide open. Likewise, in other examinations, he found the inferior part unclosed towards the middle of the spermatic cord, or even as far as the internal abdominal ring; more rarely the centre was open, and still more rarely the upper part only.

Camper found, in 53 new-born infants, 23 in which the canal was not closed on both sides; 11 in which it was open on the right side; 6 on the left.

Schreger found the following relations: in 13 new-born infants, the canal was open on both sides in 8; in 6 in its centre part between the abdominal orifice and the testis; in 2 in its whole length, in which also the abdominal orifice of the right side still remained open. In the remaining 5 it was open between the abdominal fold and the testis, but only on the right side.

Paletta states that, as a rule, the complete closure of the vaginal canal takes place from the twentieth to the thirtieth day after birth.

With a knowledge of these anatomical facts, we can readily understand how it happens that a canal or receptacle exists at birth into which a portion of the intestines may enter. When this takes place, the hernia of infancy exists. It is a circumstance of very common occurrence to see an infant soon after birth with an enlargement of the scrotum, which varies in size, and sometimes disappears altogether. It attains its largest dimensions when the infant exerts its abdominal muscles; it slowly decreases and is lost sight of during repose, the recumbent posture, or in sleep. This tumour of the scrotum is due to a hernia of small intestine which protrudes from the abdominal cavity into the prolongation from the great serous peritoneal membrane, known by the name of the vaginal process of the peritoneum. This serous sheath, which, from its structure, allows of considerable distension, is thus converted into a hernial sac. The attention of pathologists was first drawn to this fact by Haller in 1749. His observations were confirmed, and the nature of the disease was still further elucidated by John Hunter and Percival Pott. Haller employed the term *hernia congenita* to express that variety in which the intestine and the testis touch each other, or are contained in the same sac; and by this name the disease has been distinguished since the date of his publication. It is, however, a most inappropriate term, inasmuch as the hernia does not exist either during intra-uterine life or at birth. A congenital imperfection, it is true, allows the descent of a hernia

soon after birth; and therefore M. Malgaigne calls it the "hernia of infancy." But even this term is not sufficiently definite. I prefer to designate it hernia into the vaginal process of the peritoneum.

4. *Of the slow and gradual development of the hernial sac.* The peritoneal membrane is capable of very great but gradual extension. This capacity is illustrated by cases of serous dropsies and of ovarian growths. In the same manner as the whole membrane yields to the general pressure of accumulating fluid, so it dilates under the influence of local pressure into a diverticulum, or sac, until it is sufficiently capacious to contain a very large part of the alimentary canal. This condition we see in those cases of enormous double scrotal hernia, which reach sometimes even below the knees.

Every hernial sac is composed of a body, or central part, above which is the neck, and below the fundus. The mouth, orifice, abdominal or ventral aperture (*le collet* of the French), is the point of immediate communication with the cavity of the peritoneum. To the tissues forming the margins or boundaries of this opening particular attention must be directed. These constitute, by their rigidity and unyielding texture, the principal impediment to the reduction of the hernia, in most cases; and it is, therefore, this part of the sac which requires to be cut in order to replace the protruded viscus within the abdominal cavity, when the reduction cannot be effected without opening the peritoneal sac.

The development of the hernial sac. The evolution of the slowly-formed hernial sac has been very completely traced and described by Drs. Jules Cloquet* and Demeaux.† I shall here quote as briefly as possible the chief facts related by the last-named pathologist.

When the peritoneum, depressed by the pressure of the abdominal viscera, traverses the walls of the abdomen, it presents, at first, the shape of a digital depression; then, of a funnel; and next, that of a finger of a glove. These forms are, however, somewhat dependent upon the region in which the hernia is developed. During this period the entrance to the hernial sac is larger than the fundus, and in these conditions a strangulation of the herniated viscus cannot take place. But when the fundus of the sac has reached those tissues which offer less resistance, it dilates, becomes rounded, and assumes a spherical shape; in this condition the entrance is more contracted than the fundus, and under these conditions strangulation may occur.

There are three periods or states in which the orifice and neck of the sac should be examined: 1st, of their formation; 2d, of their organisation; and 3d, of their contraction.

1. *The period of formation.* It is important to describe the mode of formation of the mouth of the sac, since, from certain facts, conclusions which are useful in practice may be deduced. In the formation of the hernial sac it is demonstrable that the displacement of the peritoneum is a condition of more import than the stretching of the membrane.

When the hernial sac is complete, the portion of peritoneum employed to form it may be represented by a plane membrane about three inches in diameter and ten in circumference; whilst the centre of this surface is placed

* *Recherches anatomiques sur les Hernies de l'Abdomen*, 4to, Paris, 1817; and *Recherches sur les Causes et l'Anatomie des Hernies abdominales*, 4to, Paris, 1819.

† *Recherches sur l'Evolution du Sac herniaire*, &c. 8vo, Paris, 1842.

at the fundus of the sac at the most dilated part, the periphery, folded and puckered like the mouth of a closed purse, would be placed on a level with the opening at the narrowest part, that is to say, at the orifice of the sac, supported by the ring or the canal which the hernia has traversed. This puckering has been described by all authors, and in the plates of Jules Cloquet and Langenbeck the fact is delineated. It is also attested by preparations in almost all pathological museums. During this first period, the orifice and neck of the sac exists only in a condition to be preserved by a fibrous or muscular ring, which prevents the dilatation of the peritoneum; if this is returned into the abdomen by any mechanical means, the puckering disappears, and the orifice of the sac is effaced. If the fibrous ring is cut, or widely dilated, the same phenomenon takes place. The solution of the problem of strangulation of the intestine by the muscular or fibrous rings rests upon the study of this stage of the disease; for, at a more advanced stage, the orifice of the sac itself acquires an organisation which sufficiently explains all the phenomena of which it is the focus.

The second period, that of organisation. We may now examine the series of phenomena which take place in the neck and orifice of a perfectly-formed hernial sac. In the first period, the puckering only exists in such a condition as to be preserved by a ring; but, at a more advanced period, the different peritoneal folds form adhesions together, in consequence of the prolonged contact of their serous surfaces, and then the mouth or orifice of the sac exists independently of other structures; it becomes a new organ, annexed to the peritoneum, and has no longer need of being supported by the ring in order to exist. From this moment the orifice has an evolution peculiar to itself; it becomes the seat of very remarkable phenomena, which may be observed at different periods, and which may now be explained.

The serous surface is not alone the seat of morbid action relating to the organisation of the orifice. In the subserous connective tissue changes of no less interest take place. The adipose tissue in this part diminishes, and even disappears, although the person be very fat. The connective and adipose tissues seem to be transformed into a new covering, which encloses a large quantity of blood-vessels. This rich vascularisation is often seen through the transparent peritoneum of the periphery of the herniary opening, converging from all parts towards the orifice, and afterwards radiating on the superior part of the sac, where it is insensibly lost by blending with the connective tissue.

M. Demeaux considers that the organisation of this annular induration begins in the sub-peritoneal connective tissue, and that at a certain time the peritoneum itself undergoes a change; it becomes vascular, and the two structures united together adhere closely. This induration of the internal surface of the orifice of old hernial sacs is due to an annular thickening of the peritoneum, nearly limited to the boundaries of the mouth of the sac, which is thus reduced to much less dimensions than any other part of it. Preparations demonstrating these conditions, with the exception of the vascularity, are preserved in the Museums of the Royal College of Surgeons and of the different hospitals of London.

A layer of fibres, which interlace in every direction and resemble the tissue of the dartos, is said to exist around the orifice of the sac. If these be contractile fibres, they must exert considerable influence to prevent the reduction of a hernia, and may be considered as *one* impediment to that result. Are they not, probably, an excess of development of the contractile fibres of the connective tissue? M. Desprez considers them to be an exaggeration of the normal state. This dartos-like layer, having contractile properties, may also play its part in producing strangulation of some varieties of hernia.

The third period is one of contraction. Most writers on hernia have remarked the constant tendency which the orifice of the sac has to contract, and even to become obliterated, as soon as the herniated organs cease to act upon it.

This process is demonstrated in the cases of adhesion of the embouchure

of the sac in infants; closure of its orifice in adults; and obliteration of the sac by persistence of omentum in its cavity. This termination, the most desirable of all, does not constantly occur. A gradual contraction may take place without the obliteration being complete; it is this disposition especially which gives rise to such formidable accidents.

At this period, if the orifice be examined anatomically, it is easy to prove that it has been the seat of a new transformation. In proportion as the tissues around the orifice become thicker and contract, their vascularity diminishes; and this layer, originally resembling the dartos, shows the firmness and resistance of fibrous tissue. In the second period, the orifice, susceptible perhaps of contracting spasmodically, may also permit of slight dilatation. In the third, all dilatation becomes impossible; either the margins of the orifice resist the pressure of the viscera, or the viscus which passes through the orifice becomes strangulated.

The tissues composing this annular contraction of the mouth of the sac often become nearly as hard as cartilage; and this change especially occurs in old cases, when the hernia has not been allowed to descend for a long time; for then the boundaries of the orifice are placed in the most favourable position for the process of contraction and induration to take place. But when the hernia is not reduced, the constant pressure of the viscera dilates the mouth of the sac as well as the fibrous rings.

Of the two kinds of hernial sac.

The "hernial sac" is always a prolongation of the parietal peritoneum from the abdominal cavity into the neighbouring structures. Its development and formation, however, depend upon very opposite causes. Two kinds require to be described; the intrinsic and essential distinction between them depending upon their mode of development.

1. That kind which, being congenital, is merely a serous canal or sheath, the vaginal process of the peritoneum, until a hernia takes place and escapes into it, when it becomes converted into a hernial sac. The physiological designation for it would be THE CONGENITAL HERNIAL SAC.

2. That kind which is the result of a slow and gradual process of relaxation, and is produced by a stretching, yielding, or elongation of the parietal peritoneum, before and under the pressure of the viscus itself, which constitutes the hernia. For the sake of brevity, this kind may be termed THE ACQUIRED HERNIAL SAC.

The first kind, or congenital serous canal, which may become converted into the congenital hernial sac, sometimes exists throughout life simply as a diverticulum of the peritoneum, and without a hernia entering it; but the second kind, the acquired hernial sac, cannot exist unless a viscus, almost entirely invested by peritoneum, pushes the parietal layer of that membrane before it.

In other words, the first kind of sac is peculiar to a person born with any portion of the vaginal process of the peritoneum open, and who then possesses a receptacle for the ready irruption of a

hernia ; and, if the ventral orifice and cavity of this sheath should not become obliterated soon after birth, a rupture may occur at any subsequent period of life ; but the second kind being an acquired formation, some length of time is necessary for its production, and it cannot exist at all without the continued and effective influence of the hernia itself.

Pott, writing of the two varieties of oblique inguinal hernia, the congenital and ordinary, expresses his belief "that common ruptures, or those in a common sac, are generally gradually formed, that is, they are first inguinal, and by degrees become scrotal ; but the congenital are seldom if ever remembered by the patient to have been in the groin only."*

The paramount importance of a due appreciation of the physiological differences between the one kind of hernial sac and the other will be demonstrated in many points of view, but especially with regard to the surgical treatment of hernia.

The treatment of reducible hernia. The surgical treatment of all kinds of reducible abdominal hernia is divisible into two categories :

1. The employment of palliative or prophylactic measures.
2. The adoption of some proceeding designed to effect a permanent cure.

1. *Palliative measures.* To this class belong all contrivances which prevent the descent of the hernia. These are the recumbent posture, bandages and trusses of various descriptions. If we only judge from the class of cases observed in the hospitals, and selected from among the labouring population, we should form a very incorrect estimate of the advantage which accrues to sufferers with hernia by the employment of well-adjusted trusses. We know of adult persons in comfortable circumstances who, having no need for toil, have taken precautionary measures to prevent the recurrence of the rupture, and have consequently been free from every thing of the kind for several years after. Some have even been enabled to dispense with the use of the truss entirely, after wearing it some months. It is, however, a condition of the utmost practical importance that the case be treated immediately that the disposition to the formation of rupture is detected. When the hernia enters the vaginal process of the peritoneum, and that sheath is converted into the hernial sac, we may hope to effect a cure by attempting to call

* *The Chirurgical Works of P. Pott*, edit. 1808, vol. ii. p. 120.

forth the processes adopted by nature to close its orifice and obliterate that canal; or, in other words, to procure adhesions of the serous surfaces of this peritoneal diverticulum.

On the other hand, in the slowly-forming hernial sac the object in making use of a truss should be, in the first instance, to prevent the development of the peritoneal sac. This may be accomplished by applying support to those weak parts of the abdominal walls through which the parietal peritoneum is forced. When, however, the sac is once developed,—and this is commonly the period at which a Surgeon is consulted,—measures should be immediately adopted to assist in arresting its dilatation by preventing the descent of the rupture.

The expediency of judiciously pursuing the mechanical treatment of every variety of hernia cannot be too strongly urged upon the laity by the profession. In both sexes it should be carefully conducted the moment that the slightest protrusion shows itself. Whether the hernia occur in infancy, youth, at middle age, or at later periods of life, if properly watched and judiciously supported, it usually gives but little trouble; in many cases it is even cured. But, on the contrary, if it be neglected, increase in bulk, and, sooner or later, diseased states of the rupture, often leading to the death of the individual, will almost infallibly occur.

The only exception to be made to this rule applies to those rare cases of hernia into the vaginal process of the peritoneum in which the abnormal situation of the testis interposes a practical difficulty to wearing a truss, the necessary pressure of which occasions intolerable pain by compressing that organ simultaneously. But even such cases should not be abandoned as hopeless of cure, without a reasonable attempt being first made to afford relief.

The practice of leaving cases of rupture in the hands of mere tradesmen cannot be too strongly censured. Among the poor we constantly observe the lamentable effects of this proceeding. Ill-shaped trusses are applied; the springs, being too feeble, allow the hernia to descend behind the pad, where it becomes compressed; or they are too strong, and their pressure induces absorption of the abdominal parietes, on which the pad presses. Frequently a truss suitable for supporting a femoral hernia is applied to one of the inguinal kind, and *vice versâ*. That which is worth doing at all is always worth doing well. This injunction receives strong confirmatory testimony in the treatment of ruptures by mechanical means.

Characteristics of trusses. The requisite and essential qualities of a truss are lightness, firmness, elasticity, so that it shall retain the required form or

shape, suitable adaptation to the configuration of the wearer, and sufficient strength of spring to prevent the escape of the rupture from the abdomen.

The instrument consists of a pad or cushion attached to a metallic spring, with straps, so arranged that its movement during the varied postures of the body may be restrained.

Through the kindness of Mr. J. A. Kingdon, Surgeon to the City-of-London Truss-Society, we are enabled to give the results of his extensive experience in the employment of trusses.

He considers that the circular spring truss is the most suitable form, in the majority of cases. Bandages which are not elastic do not afford sufficient support to the hernia in every posture of the body. They are necessarily unsafe on this account, as they become lax in the stooping posture of the wearer,—the position of all others in which the hernia most easily descends, because of the relaxation of the pillars of the external ring. The curve of the spring and the relative position of the pad with it should be appropriate to the configuration of the wearer. A single piece of metal should form the spring and foundation of the pad. As far as practicable, the spring of the truss should pass around the bony rim of the pelvis, fitting closely to the figure, and should lie out of the region of the glutæi muscles. For, unless it be so placed, their alternate action in progression produces a corresponding movement of the pad. If these muscles be largely developed, extending upwards to the very edge of the pelvis, the curve of the spring should be wide at the shoulder, so that its bearing or resting part may be on the base of the sacrum.

For a single-pad truss the free end of the metal spring should be beaten out flat and thin, and so ground as to cling around the opposite hip,—an arrangement which materially aids in steadying the truss.

The form of the spring may be designated as after the French model or the German. The former resembles the coil of a watch-spring, and is very elastic and clinging; the latter almost exactly fits the outline of the body in its state of repose. It is almost inelastic, and very hard. The French is always pressing inwards, even when the wearer is at rest. The German scarcely presses at all when the abdomen is soft, but resists with power when any expulsive force makes the abdomen swell. In practice, the best shape for the spring is one which forms a medium between these two extremes.

The pad or cushion should be of moderate dimensions. For the adult, it should not exceed two and a half inches in length, and two inches at the widest part. Its superior edge should follow the upper line of the spring, which falls a little from the shoulder or bend, where it lies in contact with the hip. The inner surface should be directed slightly upwards, but this inclination must depend upon the prominence, or otherwise, of the abdomen, as well as, in some measure, on the anatomical relations of the pelvis to the spine. The proper shape for the cushion or pad, and the materials of which it should be constructed, may be varied to accommodate particular cases, or to accord with the views of different inventors. Generally, the wearer discovers, after a little experience, which kind of pad is most free from annoyance. That pad, however, is the best which maintains perfect and unintermitting retention of the hernia. Every pad should have attached to it two studs, one near its junction with the spring, and another at its lowest point. To the upper one the transverse strap passing from the free end of the spring is attached. The lower stud is used with the thigh-strap, which should be always worn. It is loosely fastened on to the spring of the truss near its shoulder, and should fall along the hollow beneath the buttock. In the erect posture of the wearer this strap should be moderately tight. It prevents the pad from shifting from its proper position, and should never be discarded.

These appear to be the general principles by which a Surgeon is to be guided in the selection of a truss. Particular modifications suitable for special kinds of hernia will be noticed in other places.

Of the so-called radical cure of a hernia. It would be idle to enroach upon the limits of this essay by describing in detail every

method employed to effect a cure of hernia, from the most remote periods. A mere notice of them will suffice. They were—castration; cauterisation of the orifice and neck of the sac; ligature applied around the neck of the sac; incision of the sac, and subsequent healing of the wound by granulation; excision, suture, and scarification of the sac; detaching the sac from its connexions and returning it into the abdomen; immediate and forcible compression of the sac by a bandage or truss; cold douche; stimulating injections, especially tincture of iodine. Such proceedings have been long abandoned, in consequence of the fatal results which frequently attended their employment.

We must, however, add the treatment recently adopted, namely, invagination of the hernial sac. Every modification of this operation is usually designated by the name of the inventor: thus there is the method of Gerdy, of Wutzer, of Rothmund, and others.*

The principle of this operation is expressed by the words, “invagination of the hernial sac.” That is to say, the fundus of the sac is pushed up into its mouth, and retained there until adhesions have formed between it and the entire circumference of the orifice. By this means it is hoped that obliteration of the ventral orifice of the sac and of its cavity may become permanently established. It is an indisputable fact, that cases of reducible inguinal hernia have been permanently cured by the performance of an operation on the plan of Wutzer. We have not, however, the data by which to establish the proportion of cures to failures; but that a considerable number of the cases operated upon did fail, is certain.

Mr. Kingdon has very kindly given me the notes of sixteen cases in which an operation for the radical cure of the rupture had been performed, either by London, provincial, or colonial Surgeons. The patients applied to him for relief at the City-of-London Truss-Society. In most of these persons, at the time they ceased to be under the observation of the operator, the rupture was “cured;” for reports of some of the cases appear in the medical periodicals of the day. In some of these patients the rupture was larger than before the operation, and greater difficulty was experienced in retaining it within the abdomen. In others, a protrusion existed on both sides, the second having become developed after the operation.

Through the intervention of Dr. Hermann Weber, Physician to the German Hospital, I have received a valuable communication from Dr. Otto Weber, of Bonn, who was formerly clinical assistant to Professor Wutzer. The number of persons upon whom the Professor operated amounts to about fourteen. Between 1852 and 1856 the operation was performed but once in the “Klinik,” during which time Dr. Otto Weber was clinical assistant to Wutzer. The patient was a teacher, forty years old. He quitted the hospital “cured,” but the hernia returned in spite of his having worn a truss.

Wutzer is still of opinion—1. That when the operation is properly per-

* The most complete account, especially of the German cases, is to be found in Günther, *Lehre von den blutigen Operationen*, Lieferung 50.

formed after his method, it is not attended with danger. 2. That he has succeeded in fixing the plug of skin with invagination of the hernial sac by inducing adhesions between its internal surface and the interior of its neck. 3. That in consequence of this, if the patient continues to wear a truss (for life), a return of the hernia may be avoided.

However, Dr. O. Weber writes, that he has never seen any of the so-called "cured cases" radically cured, but that—First, the plug of skin is, by degrees, entirely drawn out again. Secondly, that the true herniary apertures, the external and internal rings, are not closed by the operation; and thirdly, that an imperfect cure may be effected by means of a partial closure, by adhesion of the internal walls of the neck of the hernial sac, and thickening of the surrounding connective tissue.

The cases which Dr. O. Weber had an opportunity of examining some time after the operation, showed a slight protrusion of the intestine into the inguinal canal; and there would have been a perfect return of the hernia if trusses had not been worn. It appears that, at first, the invaginated skin becomes adherent to the inguinal canal, but without the participation of the hernial sac; that the latter probably becomes merely compressed by the invaginated skin passing by its side. In the most favourable cases the inner walls of the hernial sac may adhere together, but so loosely that they soon become separated by pressure.

The results of the examination of the bodies of persons after death upon whom the operation had been performed, are very important. Streubel has published some. Dr. O. Weber examined the body of a man who died of pneumonia in 1856, and upon whom Wutzer operated in 1840. The hernia had returned after the operation. There was not a trace of the invaginated skin in the inguinal canal, and the peritoneum did not show any signs of previous inflammation. The hernia and its sac did not differ from the ordinary cases of the same kind.

Dr. O. Weber thinks that Wutzer's method might be perhaps modified in such a manner as to become effective. But, first, he considers it is necessary to show upon the dead body that the fundus of the hernial sac can be actually invaginated into its orifice, and not merely pushed up a certain distance before the integuments.

But, instead of describing in detail the operation of Wutzer and its modifications,* let us inquire what is the object the Surgeon has in contemplation when proposing to perform an operation for the radical cure of a hernia. In order to be effectual and permanent, it must, of course, produce the obliteration of the hernial sac; the closure of its ventral orifice; the strengthening of those weak parts in the walls of the abdomen through which the rupture protrudes; and to these conditions must be also added, an improved tone of the peritoneal ligaments of the viscera, by which the power they exert in retaining the viscera in their normal situation is restored. Unless the operation perfectly and completely accomplishes these ends, failure must most certainly ensue sooner or later.

Another intention which the successful issue of the operation is expected to fulfil, is to enable the sufferer to dispense with the use of a truss, and thus to be free from an intolerable incumbrance. To recommend a dangerous operation, therefore, which may prove only

* Operations intended to effect the radical cure will be described with the treatment of the special kinds of hernia.

so far successful as to impede the descent of a hernia, but yet leaves the patient under the necessity of continuing to wear a truss to prevent a recurrence of the rupture, is surely scarcely justifiable. It is contended by the advocates for the operation that the dangers to which the patient is subjected have been too prominently set forth. This may be true. Few persons have indeed died from peritonitis, or other causes, in proportion to the numbers upon whom the operation has been performed. But they all were subjected to that risk, and because they happily escaped the fatal complication, that is no ground for the inference that others would do so also. The facts only show that the operation may be done without exciting peritonitis in every case.

The Surgeon, in the attempt to carry out his object, proposes to produce an effect in imitation of the processes of nature during the early periods of life; for there are facts to demonstrate that the cavity of the vaginal process of the peritoneum, which is, in so many cases, an apt receptacle for any protruded viscus, may become obliterated even after a hernia has passed into it in early infancy. But where is the evidence to prove that an acquired hernial sac becomes thus obliterated by similar natural efforts? The only instances, perhaps, are those in which the orifice of the sac is plugged by adherent omentum; and such cases are very rare.

We therefore believe that we shall not err in enunciating the principle that the cases of inguinal hernia selected for the performance of all operations for the radical cure should be those in which the protruded viscus has descended into a patent vaginal process of the peritoneum, and that all other kinds should be rejected as unsuitable; and that the more efficiently the proposed methods accomplish the ends effected by the processes of nature, the more worthy of confidence they become. Thus, allowing nature to guide our procedure, we must make it a rule to select those cases in which her efforts have failed; and by acting as her handmaid, we may reasonably hope to arrive at a successful result.

We may conclude these observations with the following quotation from the work of Mr. Lawrence: "The subject of an incarcerated rupture submits to an operation in order to save his life. But he whose hernia is reducible, endangers his life to get rid of an inconvenience; and the operation affords no greater prospect of entire recovery than he had without it. For after he has undergone an operation, at the hazard of life, the complaint may return; and the only protection against relapse is to wear a truss" (*Treatise on Ruptures*, chap. vi.).

The morbid conditions of the hernia, and impediments to its reduction. A hernia is said to be reducible when the protruded viscera can be returned into the abdominal cavity; it is irreducible when they cannot.

The impediments to the reduction of a hernia may be classed in three groups: those produced by the tissues outside the sac; those occasioned by the sac itself; and those which exist within the sac.

There are also primary or immediate causes which render a hernia irreducible, as well as secondary. Among the first we may include all those impediments to reduction which depend upon organic conditions, and relate directly to the hernial sac; as, the muscular contraction which influences the size of the abdominal rings and the tension of the tissues around the orifice of the sac; the condition of the orifice of the sac itself; and the development within the sac of adhesions or omental sacs.

The secondary are those which are partly exclusive of the hernial tumour, and occur, as it were, accidentally, and are merely due to individual peculiarities; as, for example, the development of a thick layer of fat around the hernial tumour; its great mobility; its diminutiveness; tension of the sac from accumulation of the fluid or gaseous contents of the bowel; adherent omentum lying in front of the intestine; and some other conditions.

The morbid conditions of the hernia which give rise to more or less serious difficulties may be classed under one of the following states: 1. Permanent irreducibility. 2. Distension or inflation by fluid, gaseous, or solid contents, termed obstruction. 3. Inflammation. 4. Strangulation.

1. A hernia becomes permanently irreducible, after many years' existence, on account of its size. In most cases this condition is attributable to neglect of the use of a truss. The largest double rupture I have seen was in a bricklayer, fifty-five years old, whose bodily health, strength, and conformation were in other respects very good. The left hernial tumour was the larger, although it had only existed about three years, whilst the right had been there twelve. The lowest border of the tumour very nearly reached to a level with the patellæ. Its circumference in the largest part measured thirty inches.

Adhesions also, formed between the contents of the sac, or between the sac and its contents, prevent the reduction of the protrusion.

2. Distension; choking; obstruction; rendering the hernia irreducible. This particular state or condition of a hernia is attributed to the accumulation of the solid, fluid, or gaseous contents of the alimentary canal within that portion of the bowel which constitutes the protrusion. From this cause the passage of the stercoraceous contents of the canal are arrested; the alimentary canal or tube becomes choked up with its own secretions and the egesta of the stomach, giving rise to local troubles and constitutional disturbance.

The doctrine of obstruction is of great antiquity, and for a long period that morbid condition of a hernia we now term "strangulation" was believed to originate in this cause alone. "During nineteen centuries," writes M. Broca, "the existence of an accumulation of faecal matter in the hernia had been admitted, or rather supposed; but when it was looked for, the accumulation was not to be found. Thus theory fell to the ground on the first observation."

The local symptoms of an obstructed hernia are pain, a flatulent state of the tumour, increase of size in comparison with its usual dimensions, more or less tension, and the absence of those more severe local conditions which characterise a strangulated bowel. By careful manipulation, the gaseous and fluid contents of an enterocele may be expressed into the contiguous part of the canal, and even solid faecal matter may be felt. During this proceeding the gurgling produced by the flatus and fluid is heard, and the movement of these is sometimes felt as they escape through that portion of the bowel lying within the orifice of the sac.

At first, the constitutional symptoms indicate functional disturbance of the alimentary canal, rather than any morbid state of the tissues of the herniated viscus. There are indications merely of a blocking-up of the tube, and nothing more. Thus, slight pyrexia and nausea, succeeded by vomiting, are the most marked features, which continue even although the large intestine below that portion in the sac has been emptied of its contents after the commencement of the attack. Unless the vomiting be very prolonged, and great depression result therefrom, as occasionally happens in very delicate or old persons, the Surgeon will not fail to remark the absence of the urgent symptoms characteristic of strangulated bowel.

In most cases of obstruction the impediment is removed by those means which excite the natural peristaltic movements of the alimentary tube. The local application of warmth and moisture to allay pain; repose; the administration of aperient enemata, or even in some cases, when vomiting has not occurred, of purgatives, by the mouth, are beneficial. Abstaining, in the first instance, from manipulation of the tumour, is a point of great importance. Should the impediment to the passage of the indurated faecal matter depend upon the contraction of the orifice of the sac, the enlargement of this part becomes necessary, either by cutting its tissues or those around it. The operation must then be performed in the usual manner, and in relation to the special case.

3. *Inflammation of a hernia.* A hernia in this state shows all the local signs, and excites the constitutional symptoms of inflammation. The combination of those indications which characterise the condition called strangulation do not, however, exist.

Inflammation is usually the result of external violence, and may be produced by the pressure of badly-fitting trusses. A morbid

state of the whole alimentary canal, of an inflammatory type, may extend to the hernia, and in that way give rise to local trouble.

Irreducible epiploceles are more liable to be inflamed than other kinds of hernia; and a patient the subject of reducible epiplocele may have the hernia inflamed, from which cause it becomes permanently irreducible by contracting adhesions to the sac.

The local signs are pain, increase in the bulk of the tumour, a certain degree of hardness, firmness, and elasticity when it is pressed, with more or less unevenness and irregularity of surface. The margins of the aperture through which the hernia passes do not tightly embrace the protrusion, so that, in large hernia, the finger can be passed along the pedicle of the tumour for some distance.

The constitutional symptoms are not usually severe. In the first stages more or less pyrexia arises; and when the contents of the tube are arrested in their course, the indications of that condition become marked.

It is unnecessary to describe in detail the local and constitutional measures to be adopted. Reliance must be placed upon those in ordinary use to control and arrest the disease.

4. *Strangulation.* A hernia is said to be strangulated when the displaced viscus is subjected to a constriction which impedes or arrests the circulation of the blood through its vessels, and the passage of the stercoraceous materials along its canal, and also causes an impediment to its return into the abdominal cavity. This condition excites constitutional symptoms of a most serious and characteristic kind.

Is the condition of a hernia, termed strangulation, solely the result of mechanical constriction produced by the margins of the orifice of the sac; or does it depend upon a morbid action engendered in the tissues of the protruded bowel antecedent to its escape from the abdominal cavity? In several instances of strangulated femoral hernia in women, and in some cases of inguinal hernia in men, the patients themselves voluntarily stated that, for some hours before the hernia caused any inconvenience, or any even in the sac, their bowels had been "disordered," "relaxed," or that they had been suffering with "bowel-complaint." In other cases, there seemed to be a great tendency to a very rapid derangement of the mucous membrane along the whole track of the canal above the hernia, scarcely explicable upon the supposition that it had been all excited by the mere existence of a constriction around a small knuckle of intestine. As evidence of this morbid action, I would adduce the fact of the rapid and abundant secretion from the entire mucous surface of the small intestines, their great distension and intense vascular congestion, witnessed in some instances.

Again, given any case of reducible hernia, which for months, or even years, has readily glided into the hernial sac, and has been returned as easily into the abdominal cavity, why on some particular occasion should it become irreducible when it has passed through the same orifice it has been in the

habit of traversing, and in the tissues of which no appreciable changes have occurred? For it is in vain we seek any marked alteration in the structures around or composing the orifice of the hernial sac itself.

In giving an affirmative reply to the above inquiry, we are justified by facts in attributing the strangulated state of a hernia to a predisposing cause, commencing in a morbid state of the alimentary canal generally; at least, in some cases. Patients often relate how they had observed that the hernial tumour was "larger than usual" before they suffered much inconvenience; and this circumstance is commonly attributed by them to a greater bulk of the protruding viscus. But we have no proof that this is the correct explanation of the increase of size of the tumour in all cases; in some doubtless it may be. It is due to a distended state of the bowel rather than to quantity.

Let us examine a case of reducible inguino-scrotal enterocele. At one moment all that the Surgeon can detect is a slight fulness produced by an empty hernial sac. At another, a small knuckle of intestine, having descended in an empty condition, becomes more or less filled with the stercoraceous contents of the alimentary canal from above it, and an elastic swelling results, which is produced by the bowel and its contents, fluid and gaseous. Assisted by the peristaltic movement of the viscus itself, or by gentle pressure, these contents of the tube are conveyed along the proper channel, and the hernia, that is, the bowel, is emptied, and it readily resumes its normal position in the abdominal cavity. Observe, now, that the tissues of the bowel have undergone no change. But let the distension continue, and the first indications of mischief are local pain and an enlargement of the swelling; next, a sensation of uneasiness in the hypogastrium, of dragging from the rupture upwards, still greater increase in the magnitude of the tumour, and great pain when handling it, take place. Do we not recognise in these phenomena the peristaltic action of the canal, the swelling of the tissues of the hernia by congestion of its vessels and irritation of its nerves? During these progressive stages the protrusion has attained a size dependent upon more than one cause. Distension, caused by accumulation of its contents, and swelling of its tissues, induced by the effusion of inflammatory products, reacting against the narrow orifice of the sac, produce more or less retardation or arrestation of the sanguineous current in the blood-vessels of the rupture, and its strangulation is the result. The increased bulk of the protrusion prevents its retrograde passage through the small aperture by which it escaped from the abdomen. The body of the sac being also stretched, may mechanically contract the dimensions of its orifice in some measure; whilst the arrangement of the whole tumour, in relation to the mouth of the sac, may likewise afford an impediment to its reduction.

The filaments of the nerves of the injured bowel play an important part in transmitting thence to the nervous centres the local disturbance of their sentient extremities, and constitutional sympathies are excited. The heart contracts more frequently, and with greater force; the pulse is full, and more frequent than normal; the cheeks are flushed; the surface of the body is warmer than usual, often moist, though sometimes dry; the tongue is covered with a white fur; nausea and intolerance of food are complained of; tenesmus occurs, and flatus or a small quantity of fæces may be expelled, if the large intestines chance to contain any.

Uncontrollable retching and vomiting become the next established features of the disease; prostration of the bodily powers rapidly supervenes, and death may take place at this stage from collapse alone.

Enlarging upon this brief sketch of the symptoms which indicate the commencement and progress of strangulation of intestine, we must now systematically describe—

First, the condition of the hernia when strangulated.

Secondly, the changes taking place in the tumour.

Thirdly, the constitutional symptoms excited by the local disease ; and,

Fourthly, the morbid conditions developed within the abdominal cavity.

The structural changes taking place in the hernia. When the bowel is in the condition implied by the word "strangulation," the circulation of the blood within the vessels of the part is, at first, impeded. Congestion of the capillary vessels is the consequence, and the tissues of the viscus become swollen. When exposed to view, in this first stage, the serous membrane is of a deep-red tint, and through a lens the minute blood-vessels may be distinctly seen, with their outlines well defined. To the touch the hernia feels firm, and resists slight pressure ; but the elasticity and resiliency of its tissues still continue unimpaired.

Next, the circulation of the blood is arrested. The tissues of the bowel, about which the constriction is tight, become now more swollen ; they have palpably a solid, leathery consistence ; the colour of the serous surface is a dark purple ; it is dull, lacks its usual lustre, and sometimes, varying as regards shade or depth of colour, it is mottled with a red and purple tint. Patches of extravasated blood appear in the subserous connective tissue, and an adhesiveness to the fingers is very striking.

When the bowel has been strangulated many hours, its tissues are more swollen and soft ; they no longer possess their characteristic elasticity, but they remain in the same position in which the pressure of the finger places them. The serous surface has lost all its characteristics ; it is black, ash-coloured, flocculent, and adhesive. In this stage all the tissues of the bowel have undergone more or less disorganisation ; blood is extravasated in the connective tissues between the different coats of the viscus ; the mucous membrane is soft, flocculent, and easily detached from the fibrous walls. Probably in some part of the bowel, at its convexity, or where it is in immediate relation with the mouth of the sac, its tissues have sloughed, or ulceration is concealed by shreds or patches of adherent lymph. The intestine is also usually firmly fixed to the mouth of the sac by inflammatory adhesions.

The last stage is that in which the entire mass of the protruding bowel has become gangrenous, or has passed into a condition termed sphacelus.

In the diseased conditions just described we may recognise morbid changes similar to those which are observed in structures on the outside of the body. If a string be tied around the penis

near the prepuce, the latter organ becomes first swollen; secondly, inflamed; thirdly, it suppurates; and lastly, it mortifies. Ulceration also takes place at the part with which the ligature is in contact.

The various tissues of which the bowel is composed are endowed with different powers of resistance to these morbid processes. Thus it may be seen, on cutting open the intestine, in cases in which the bowel has been deeply sulcated or grooved on its serous surface, without any trace of abrasion thereon, that the mucous membrane is ulcerated in a line corresponding to the part immediately embraced by the medium of constriction. Occasionally it happens that the line of ulceration forms only at that end of the strangulated bowel directly continuous with the upper and distended portion of the alimentary tube, whilst there is none at the other end. This is probably caused by the pressure of the distended bowel within the abdomen, and it may be seen, particularly in some cases where the knuckle of intestine lies in close relation with Gimbernat's ligament.

Mr. Bryant states* that ulceration at the line of stricture is most frequent in inguinal hernia, although the sulcated condition of the bowel is as common in femoral as in inguinal; and that fæcal extravasation, if not produced by ruptured bowel from taxis, generally follows ulceration at the line of stricture.

Small, recently-developed herniæ are more frequently strangulated than large ones, and those which have existed some time. Sir A. Cooper writes: "A small hernia is more easily strangulated than a large one, the pressure on the contents being more violent, and the symptoms are much more urgent, as the stricture acts with much more effect upon a single knuckle in stopping its circulation, than when the contents of a hernia are large and voluminous."†

It is a matter of great importance to distinguish between the two classes of hernia—"RECENT" and "OLD." Mr. Pott observes: "Recent hernias are in general more liable to stricture than old ones, for reasons which are obvious from what has already been said; but when old ones get into the same circumstances, the symptoms are much the same; though I think in general they are not altogether so pressing, and the latter generally admit of more time to attempt reduction in."‡

And very lately Mr. Bryant has demonstrated, by the cases

* *Guy's Hospital Reports*, 1856.

† *The Anatomy and Surgical Treatment of Abdominal Hernia*, part i. chap. vii., the last paragraph.

‡ *The Chirurgical Works of P. Pott*, edit. 1808, vol. ii. p. 63.

admitted into Guy's Hospital, that in recent hernia strangulation frequently occurs, and that the risk attending it is very great, even although the bowel be speedily liberated.*

Morbid states of the hernia induced by violent manual pressure. Let it not, however, be assumed, that the morbid conditions of a hernia, now described, are always inevitably due to the compression which the orifice of the sac has exerted around it. Such is not the fact. The tissues of the herniated viscus are rarely so firmly constricted as to produce in a short space of time complete mortification, absolute death, of the whole of the knuckle of bowel in the sac; yet this state of the hernia is often met with. In these cases the protruded viscus has been subject to another source of damage and destruction. Under the mild expression of "the use of the taxis," the hernia has been forcibly compressed by manipulation; its tissues have been contused and irreparably damaged; blood has been extravasated in profusion between the different layers of the tissues composing the viscus, and complete disorganisation of its structures is the result of the injury inflicted. I have been for many years interested in ascertaining, from the observation of the state of the bowel after death, the comparative amount of injury inflicted on the viscus by the natural constriction of the orifice of the sac, with the tissues around it, and that produced by violent manipulation of the tumour, with the hope of reducing the hernia. I am constrained to state that the damage produced by the first cause is in no degree commensurate with that which results from the last; and that in all the instances in which the entire bulk of the herniated bowel was in a state of sphacelus, that condition was the result of violent, protracted, and ill-applied manipulation. The progress of these morbid processes is likewise accelerated by the same means; for it does not often happen that mortification of the whole piece of the bowel is observed in those cases in which the nature of the disorder happens not to have been recognised very early, and when the manipulation of the tumour has not been employed.

I may represent the danger which is associated with violent attempts to reduce the hernia, by stating, in a few words, that more irreparable damage may be inflicted on the bowel in a few minutes by coarse, careless, impetuous brute force, than the natural means of constriction could produce in several hours.

Need I add, that in the attempts to reduce a strangulated hernia, the employment of such violence as must be necessary to produce these results is reprehensible in the extreme, and is justly condemned as not only opposed to every sense of humanity, but because it is in violation of all the principles of practical surgery?

Artificial anus. Two conditions of the intestine lead to the formation of an artificial anus. One, in which a portion only of the wall of the intestine sloughs, leaving a small ulcerated opening as if a piece had been punched out, which does not interfere with the continuity of the alimentary canal, although it allows a portion of its contents to escape. This opening commonly forms at about the centre of the convex free-border of the knuckle of intestine, and at a point farthest removed from the orifice of the sac.

Another variety is due to ulceration of all the coats of the bowel, even to the mesentery. It usually occurs in the part of intestine at the mouth of the sac; and, in consequence, the con-

* *Guy's Hospital Reports*, 1861.

tinuity of the canal is destroyed, and all the stercoraceous matter escapes through the opening.

Intermediate between these two extremes we meet with varieties in which more or less of the walls of the tube is destroyed, producing corresponding results. I may state that, after the first accident, repair of the hole frequently takes place, the wound of the integuments heals perfectly, and complete recovery ensues.

After the second, however, the prognosis is not so favourable; for, commonly, an artificial anus is permanently established, and more or less of the contents of the alimentary tube are discharged thereat.

As the result of long-continued constriction by the mouth of the sac, and the pressure made upon the two pieces of intestine lying therein, their walls become adherent at the points of contact, ulceration takes place, and the continuity of the tube is thus established within the abdomen, by the processes of nature alone. This condition is very rarely met with, and I may therefore refer the reader to a published case.*

Morbid conditions of the coverings of the hernia. The changes taking place in the tumour affect the hernial sac and its coverings or investments. When they are purely the result of disease induced by strangulation of the hernia, they extend progressively from within outwards; but if produced by violence in the manipulation of the tumour, the integuments show early indications of the injury by ecchymosis, as well as inflammation of the subcutaneous connective tissues, œdema, &c.

The severity of the pain caused by handling the tumour when the hernia is strangulated, differs in a remarkable manner in different individuals. In some persons the tumour becomes quickly sensitive, and even intensely painful, so that the patient is intolerant of the most gentle manipulation, especially in the region of the orifice and neck of the sac. Sometimes, in cases of acute strangulation especially, the sufferer can scarcely be induced to lie quiet in bed, but writhes about in torment, praying for instant relief. Other patients, on the contrary, endure the necessary examination and even pressure of the tumour, without evincing very marked signs of pain.

At indefinite periods, after symptoms of strangulation of the

* *Transactions of the Pathological Society*, vol. x. p. 128; the preparation is preserved in the Museum at Guy's Hospital, no. 2492¹⁰.

intestine have appeared, the size of the tumour often increases rapidly; its surface becomes more uniform and regular; the integuments tense, smooth, shining, red, with increase of temperature; and the general outline of the whole swelling assumes a more pyriform shape, or is more locally circumscribed, according to the variety of the hernia. Fluctuation may also be detected in some cases. It must, however, be remembered, that the displacement of gas by pressure upon the tumour causes a sensation very closely resembling that which indicates the presence of fluid, and that the difference between one and the other is not always perceptible even by Surgeons of great experience in delicate manipulation.

The sudden enlargement of the tumour is explained by the fact of a rapid secretion and accumulation of serum within the hernial sac, in numerous instances; by the distension of the enterocele with gases, in others.

Characters of the serum in the sac. The serum varies in character according to the duration of the strangulation. When the sac containing a strangulated hernia is cut open, some fluid usually escapes. In colour, consistence, and odour, this serum varies considerably in different cases; and these diversities may be regarded as important indications of the condition of the tissues of the strangulated bowel.

It is pale yellow, clear and bright, when strangulation has existed a few hours only; and, under these circumstances, the intestine is simply deep-red, from vascular congestion, and its tissues elastic.

It is dark-brown, but clear, when strangulation has existed many hours; and the intestine is then of a purple tint, but its tissues elastic.

Its colour resembles that of a strong infusion of coffee; it is turbid; blood and small coagula are mingled with it, when the protrusion has been long strangulated, or protracted and violent taxis employed; now the intestine is dark-purple, inclining to black; its tissues are leathery, not resilient, infiltrated with blood, and often flakes of lymph are adherent to its surface.

When turbid, dull brownish-yellow, and containing blood, coagula, pus, flakes of lymph, and even fecoid matter, in which state the odour of feces is perceptible, the intestine is usually approaching a gangrenous condition, if it have not already passed into sphacelus.

The escape of gas through serum, of the nature last described, producing bubbles, is an indication that the herniated bowel is probably ruptured, and that a communication exists with the interior of the alimentary tube.

If the progress of the disease be not arrested by the liberation of the bowel, its tissues mortify, the coverings of the sac become inflamed, infiltrated with serum, and at last with pus. Crepitation may be felt, which arises either from the development of gases in the decomposing tissues, or depends upon their escape from the alimentary tube; and finally gangrene of the skin ensues, and through the opening caused by the separation of the slough the contents of the intestinal tube escape, and an artificial anus is established.*

* John Hunter writes: "It is very curious to observe in hernias, that while the

In cases of entero-epiplocele, after the reduction of the intestine by the taxis, the irreducible omentum sometimes becomes inflamed, and, together with the sac and its coverings, suppurates, sloughs, and becomes detached in the usual manner; the patient subsequently making a good recovery.

Constitutional symptoms induced by the morbid state of the alimentary canal above the hernia. Many of the general or constitutional symptoms of strangulated hernia are excited by the morbid condition of the part of the alimentary canal above the portion herniated, more than by the state of the hernia itself. The simple obstruction to the passage of the stercoraceous contents of the tube induces severe constitutional disturbance; an illustration of which is afforded by cases where the canal is crossed by fibrous bands, or directly compressed from any other local cause.

There are so many functions disturbed by the retention of the hernia in the sac, that it is very difficult to assign the constitutional symptoms to any single circumstance, such as the constriction of the hernia. Yet it is almost impossible to deny that some very marked influence arises from this single cause alone; for what change is more marked or striking than the cessation of vomiting immediately ensuing upon the liberation of the bowel? The hernia is indisputably the primary and exciting cause; but much of the constitutional disturbance must be referred to those morbid phenomena which progressively arise as the result of mere obstruction of the alimentary canal.

We may consider these effects of obstruction under two heads. First, those produced in the portion of the viscera within the abdomen; secondly, those excited in the nervous respiratory and vascular systems.

Effects of obstruction. That part of the alimentary canal which is between the stomach and the hernia becomes by degrees distended with flatus and fluid of a dark-brown colour. The mucous

gut is in the sac and alive, no inflammation takes place on the sac or integuments; but the moment the gut becomes mortified or dead, the stimulus of an extraneous body takes place immediately; an outlet is then endeavouring to be made by the inflammation and suppuration of the sac forming an abscess in it; which matter, with the contents of the gut, is brought to the skin. While this is going on, the round gut within the abdomen, where it passes into the rings, adheres to those rings all round; so that when the abscess is formed, burst, or opened, and the mortified parts sloughed off, these ends of the gut open into the abscess, and not into the cavity of the belly." *Hunterian Ms. Descrip. Cat. of the Path. Specimens in the Mus. Roy. Coll. of Surgeons of England*, vol. iii. p. 117.

membrane is deeply injected, sometimes of the colour of blood. The serous membrane is also red, from vascular turgescence; and patches of a deep-red tint often produce mottling of its surface. After distension has been long protracted, the contractile tissues of the small intestine seem to lose their function, which in some cases they never regain. When obstruction occurs to some part of the colon, the patient sometimes dies with perforation of the coats of that bowel, or even of the cæcum. The portion between the hernia and the anus, both small and large intestine, is contracted; the mucous and serous membranes are generally pale. The bowel often contains a little tenacious mucus.

Results of peritonitis are seen after death in the form of shreds of plastic lymph adherent to and lying between the coils of the bowels; or a large quantity of sero-purulent effusion occupies the peritoneal cavity.

Constitutional symptoms of strangulated intestine. The constitutional symptoms, which are regarded as indicative of strangulated intestine, when associated with a local tumour in any site of a hernia, become marked and highly characteristic after vomiting has once commenced.

That train of symptoms seems to be mainly due, first, to nervous irritation starting from the herniated viscus, and afterwards to the interruption of the passage of the stercoraceous matter; for any circumstance producing mechanical obstruction causes very similar results. Thus, if any part of the alimentary tube be confined by adhesions, pressed upon by a tumour, or ligatured by a fibrous band within the abdomen, many of the results attending the accident resemble those of strangulated hernia. Likewise somewhat similar symptoms attend ileus, enteritis, and some forms of constipation.

It is perhaps more correct to state that certain characteristic phenomena taking place in association with a tumour, at a site where it is known hernia commonly, or even rarely, occurs, would lead to the inference that a portion of bowel had become strangulated, especially if certain local indications, superadded to mere swelling, also existed.

Usually, the first symptom the patient complains of is vomiting. Upon careful inquiry, however, it is commonly stated, especially if the case be one of old hernia, that more than usual pain had been experienced at the site of the tumour; or that, for some hours before, it was observed to be larger than usual. Nevertheless, so little trouble is sometimes occasioned by the tumour, in the first instance,

that patients often attribute the protrusion of the hernia to the effects of the straining in the act of vomiting. Occasionally, too, soon after rising from bed in the morning, the patient complains of nausea, which is rapidly succeeded by vomiting, without being previously aware of the existence of any hernial tumour. This is frequently the history of females, who perhaps have been working unusually laboriously the day previously. The same likewise happens in persons who, knowing themselves to be ruptured, and having never worn a truss, designedly conceal the fact. So little local inconvenience is sometimes caused by the hernia, that the attention of patient and medical attendant is entirely absorbed by the mere act of vomiting alone, and both continue in ignorance of the existence of the hernia.* Upon inquiry it may be elicited, if the patient enjoys ordinary intelligence, that before the nausea commenced, a sudden sensation of uneasiness was felt in the abdomen, especially about the hypogastric region; that this was followed by a repeated desire to go to stool, with tenesmus, and that nothing but a little flatus escaped.

Nature of the vomit. The composition of the vomit varies at different stages of the illness. At first, it usually consists of the substances last swallowed. Next, it consists principally of yellow bilious fluid, which after a time changes to a greenish hue; until at last the colour changes to brown, and resembles more or less closely, especially in odour, a mixture of fæces and water. It is then termed fæculent, or stercoraceous.

During the active stage of vomiting the sufferer is unable to retain any thing in the stomach for any length of time. But as an extreme state of prostration of the nervous system becomes more and more imminent, and also if the narcotic effects of opium be fully induced, the irritable condition of the stomach subsides, and may cease altogether. The Surgeon must not, however, be thrown off his guard by this apparent calm. His anxieties must not cease

* *Importance of searching for a hernia in certain cases.* In consequence, therefore, of the fatal results which almost inevitably ensue if a strangulated intestine be not speedily liberated, it is the paramount duty of every medical man, when called upon to afford relief in cases of continued vomiting, to examine those regions of the abdominal walls in which hernial protrusions take place.

After long hospital experience, during which time the number of cases of hernia coming under our observation has been very large, many of which had been entirely overlooked until the last stage, we feel it our duty to allude to another cause of destruction. Among the poor it has frequently happened that a friend of the sufferer had gone to a chemist's shop to relate the symptoms, and vomiting and constipation being the most prominent, drastic purgatives were prescribed, and repeatedly swallowed by the patient. Thus, not only was valuable time lost, but treatment of the most injurious kind adopted.

in consequence of this composed state of the patient. On the contrary, it betokens a most dangerous depression of the vital powers, a degree of exhaustion from which some persons never rally.

The stage of prostration is now established. The pulse, which during the earlier hours of the attack was more full, and beat more frequently than normal, and which, as the vomiting continued, became weaker and more rapid, now beats slowly and with little force. The surface of the body is chilled; the hands and feet are blue, their integuments shrivelled; the aspect of the countenance is one of anxiety and distress; a peculiar expression as of suddenly increased age is very characteristic; the muscular system has lost its tone; the tongue is dry, furred, and frequently brown; and the secretion of urine falls below the normal standard of quantity. At this stage the hernia is sometimes reducible. The most gentle manipulation suffices. This occurs more commonly in inguinal hernia than femoral. It probably depends upon the relaxed condition of the abdominal muscles, and the removal of the constriction they once exerted around the mouth of the sac; in the same manner as chloroform exerts a beneficial influence. Death occasionally takes place at this period of the attack. This fatal issue is attributable to the extreme prostration of the nervous system, induced by protracted vomiting; for in after-death examination of such cases we do not discover any organic lesion to cause it.*

The next stage, characterised by distinct symptoms, is that when peritonitis is developed. But this does not always occur over so large an extent of surface as to excite grave apprehensions for the result. Peritonitis is often purely local, and confined to a small area around the region in which the hernia is situated. Perhaps the local inflammation is only just sufficient to produce adhesions between the orifice of the sac and the protruded intestine. However, when general peritonitis is developed, the usual symptoms of the disease are well marked. Hiccough is especially regarded as an unfavourable indication. Peritonitis, in the most severe form, arises

* Mr. Obré showed a dissection of a case of entero-epiplocele illustrating this fact, at the Pathological Society (*Path. Trans.* vol. vii. p. 219). A woman, fifty-three years old, died after four days' strangulated bowel, without receiving medical advice. After death a small portion of intestine was found perfectly strangulated in the left femoral ring; it was intensely blue, but its tissues unaltered. The small intestines were preternaturally red, but not inflamed.

M. Malgaigne also reports a case of the same kind. Strangulation of the intestine had existed eight days, when the woman died. There was neither gangrene, ulceration, nor peritonitis. He then observes that we see that a strangulated hernia excites such an extreme depression of the vital powers that patients may succumb without any anatomical lesions appearing to produce that event. *L'Union Méd.* 1854, p. 248.

when the walls of the bowel have been perforated by ulceration, thus allowing their contents to escape into the peritoneal cavity. Intense abdominal pain immediately follows this accident, collapse supervenes, and death speedily releases the sufferer.

The last stage is collapse: a condition in which the vital powers scarcely seem to exist any longer; the sufferer, although not physically dead, yet seems to linger on the threshold of that condition. The patient may continue some hours pulseless; the extremities cold, and the breath also; the facial aspect deathlike; the power of speech but slightly impaired; until a sudden change comes over the features, and life has departed.

We have before described the pain felt in the hernial tumour. Besides this there is a peculiar sensation of tightness or constriction referred to the umbilicus. This is a highly characteristic feature of a strangulated hernia. The patient describes the suffering as resembling the effect which would be produced by encircling the mesogastrium with a tightly-drawn cord. To this is sometimes added a dragging sensation, extending from the epigastrium to the hypogastric region.

Pain, regarded as a symptom of peritonitis, is an uncertain indication. This disease frequently exists without much pain being experienced, and even pressure on the abdomen is endurable without causing complaint. Pain is more particularly absent in those cases where peritonitis arises without ruptured bowel. If, however, fecal extravasation be the cause of the peritonitis, then the pain immediately becomes intense, often agonising, indeed pathognomonic of that occurrence.

Prognosis of strangulated hernia. Hospital experience must not be regarded as a fair criterion by which to judge of the mortality induced by the effects of strangulated hernia alone. The high rate of mortality observed in this class of patients can only be considered as the result of the nature of the cases admitted into hospitals for treatment. In a large proportion of them the prospects of saving life are passed before the sufferers even leave their homes. Men and women labouring under the most adverse circumstances, irrespective of the particular disease under observation, are, for the most part, the class of sufferers submitted to treatment. Their constitutional powers have been previously and irreparably reduced by habits of life, places of residence, persistent recklessness, and usually by compulsory submission to almost every condition the reverse of conducive to health,—such are the cases hopelessly seeking to be cured. These facts alone are sufficient to account for the mortality which occurs in cases of strangulated hernia requiring a cutting operation to liberate the bowel.

Undoubtedly it is to the length of time which the bowel is allowed to remain strangulated, and to the delay in the performance of the operation for its liberation, that the high rate of mortality must be generally attributed. This circumstance cannot be too strongly impressed upon the mind of the patient; nor can the medical attendant act too promptly in the employment of the only treatment which can avert such untoward results.

Mr. James of Exeter was evidently surprised at the mortality occurring in the hospitals of London when he observes: "There can be little doubt that the majority of these fatal cases (of hernia) were the victims of time; . . . this, I am aware, is an error little imputable to the distinguished Surgeons by whom these operations were performed. It is generally the unfortunate patient who is the cause of his own disaster."*

This statement very truthfully represents the state of the case, in some instances, without doubt,—in those, for example, in which the patient, being conscious of the existence of the rupture, conceals that knowledge from his medical attendant, or refuses all interference beyond external or internal therapeutical agents. It does not remove the imputation of neglect from him who, when the case is under his medical care, leaves his patient for several hours in suffering; nor can it justify the delay which is caused by a Surgeon who, duly appreciating the nature of the illness, refrains from liberating the constricted bowel, or asking others to do so, after appropriate means have been unsuccessfully employed to return it by the taxis.

We have never known an instance of a patient dying in consequence of the bowel being liberated at too early a period; but we have had to operate upon many whose chances of life were absolutely sacrificed by the inexcusable delay which had occurred before the patient was submitted to the operation. We make this assertion after a large experience, extending over many years.

Why is it that the mortality attending strangulated hernia is so large? How does it happen that every writer upon this disease and every hospital Surgeon has to deplore the condition of patients subjected to the operation for the liberation of the bowel? The average annual mortality in this metropolis caused by hernia, and published by the Registrar-General, amounts to 148.† This average is calculated from the total number of deaths from this cause registered during the last thirteen years. The highest number recorded is for the year 1862, viz. 170; the lowest in 1850, 128. We may assume that the increase of population, and greater accuracy on the part of those certifying the causes of death, may account for the difference between these extremes,—42. Now, judging from the condition of the cases which have come into hospital under our own care, we believe we are correct in stating that the mortality might be reduced at least by two-thirds if the liberation of the bowel was effected immediately after the failure of judicious attempts to reduce the hernia by the taxis, assisted by proper means, or soon after the vomiting of fluids regurgitant from the intestinal tube. We do not hesitate to pronounce this judgment after carefully considering the facts of the cases which have accidentally fallen under our own treatment. For example, in inguinal hernia: of eight fatal cases, three were incurable in consequence of the condition of the bowel, irreparably diseased by long-continued constriction; two others were in a similar state from the bowel having been injured by violent compression employed to reduce it. Cases of femoral hernia are even still more fatal from the causes above mentioned. In twenty out of twenty-eight, the immediate cause of death was attributable to the disease of the bowel which had formed the hernia; this morbid state depending upon injury, over which the mere liberation of the bowel exerted but slight influence towards repair. For it should be remembered that the simple replacement of the viscus in the abdominal cavity does not ensure the restoration of its functions; the Surgeon only replaces it in that situation where the reparative powers of nature are most likely to exert their influence with activity; and that if the tissues of the hernia when reduced are incapable of performing their functions, those of the intestine cannot be performed, and therefore death must ensue. In several of these cases the disease of the

* *Practical Obs. on the Operations for Strangulated Hernia*, p. 79, Svo, 1859.

† *Summary of Weekly Returns of Births and Causes of Death in London*; published by the authority of the Registrar-General, 1863.

bowel was rendered still more surely irreparable by the pressure to which it had been subjected in the taxis, and in two instances the damage inflicted by this means was so great as to have absolutely killed the entire coil of intestine which was in the sac.

But all the causes which produce the morbid conditions of the bowel above mentioned, and more fully detailed in preceding pages, can be prevented. They may not be always under the control of the medical attendant, nor amenable to surgical skill; but we confidently promulgate the doctrine that the salvation of life in cases of strangulated hernia entirely depends upon the liberation of the bowel at the earliest moment practicable; and the converse may be predicated, that the destruction of life will inevitably ensue in proportion to the length of time the constriction has existed, with its constitutional consequences, and the prolonged and forcible taxis employed.

The vital importance of liberating the bowel from constriction at the earliest moment cannot be over-estimated. As upon the speedy accomplishment of this the salvation of life depends, a little precipitate action may even be forgiven, so hazardous is the position of a patient with the bowel strangulated. But, what is the risk attending the operation of exposing the hernial sac, dividing the impediment to the reduction of the hernia, and reducing it, even should the peritoneal sac require to be opened? Practically, none. In comparison with that of leaving the bowel strangulated, it is harmless.

To what cause, then, may we attribute the culpable negligence of those who leave the poorer classes of the community in this most perilous moment, —in a condition replete with jeopardy, fraught with results hazardous in the extreme? It would seem that the embarrassment and the delay are caused, not by Surgeons being timid and slow to propose a remedy, but from their really being ignorant of the amount of mischief certain to arise by allowing the constriction of the bowel to continue.

Only a few weeks since we heard a physician relate the following circumstance: Being asked to see a poor woman who had been vomiting for several hours, he discovered a hernial swelling. He suggested that a Surgeon should at once see the case, intimating that an operation was urgently needed. The gentleman in attendance immediately replied, "But will it not be desirable to wait until the vomiting has ceased before the performance of the operation?"

Can any principle be deduced from the facts detailed, to serve as a guide in determining the moment at which the attempts to reduce the hernia by the taxis should be given up, not only as hopeless of good results, but fruitful of pernicious effects, and a cutting operation be urged as the only safe means to liberate the bowel from constriction? We may certainly now assert this without fearing the accusation of too great precipitation: when the period has arrived at which it is certain, from the nature of the fluids vomited, that regurgitation of the contents of the duodenum and jejunum has taken place, any delay in effecting the reduction of the bowel is certain to be attended with progressively increasing evils. If there be evidence of regurgitation from the ileum, the condition of the patient is still more hazardous. Even assuming that the case be now seen for the first time at this period, and that attempts have not been made to reduce the protrusion, delay is inadmissible. The administration of chloroform should be recommended at once, with an understanding between the patient and the Surgeon that the

operation should be immediately performed if, when its anæsthetic effects are fully developed, he fails to reduce the hernia by manipulation.

M. Desault, fully appreciating the injury too often inflicted on the hernia by the injudicious and violent employment of the taxis, wrote: "Always think favourably of a case of strangulated hernia when the taxis has not been used."

Treatment of irreducible hernia. Reduction of the hernia by the taxis. The endeavour to reduce the hernia, which consists in displacing it from its abnormal position, and passing it through the orifice of the sac into the peritoneal cavity, by dexterous manipulation, is termed the use of the taxis. Of course, the first desire upon the part of the Surgeon is to accomplish this. But all attempts to replace the bowel in the abdominal cavity should be relinquished until the circumstances attending the special case under observation have been carefully ascertained and considered.

The principal circumstances to which attention should be directed are as follows:

1. The kind and variety of the hernia regarded in its anatomical relations.
2. The duration of its existence; whether it be of old standing and slow formation, or of recent and sudden development.
3. The constitutional condition of the patient at the immediate moment, as influenced by the present illness. The hour at which vomiting commenced; and the variations which have taken place in the composition of the fluids vomited should be determined with exactitude.
4. The state of the tumour. Its usual size when not causing illness; its bulk before vomiting commenced; the changes which have taken place in it during this stage; the pain to which it gives rise, if merely local or extending into the abdomen, with or without manipulation; the condition of its coverings; its probable contents, so far as may be conjectured by the evidence, assisted by touch and sight.
5. The treatment already adopted by the patient, the friends or other persons, before the observation of the Surgeon.

These are all subjects for profound reflection and serious meditation.

Injurious effects produced by the taxis. It is necessary to state here that irreparable injury is frequently inflicted upon the herniated

bowel by violence, used at all stages of the illness. The danger of any mischief occurring by the use of the taxis increases in proportion to the length of time the bowel has been strangulated. This necessarily arises from the tissues of the viscus becoming less and less able to resist the pressure of the hand.

The principles by which the Surgeon should be influenced, when he is desirous to reduce a hernia without the use of the knife, or by the taxis, are these :

1. Before vomiting commences. It is evidence of sound judgment to abstain from manipulation of the tumour in this stage, and until other remedial means have been tried, except with the object of forming a correct diagnostication of its nature. The taxis, unassisted, often fails to replace the protruded viscus, and in many cases upon which we have been required to operate, patients have stated that the vomiting did not commence until after the use of prolonged and forcible pressure of the tumour. If the case be one of old and slowly-forming hernia, commonly reducible, which has become more painful and larger than usual, for a few hours only, the patient should be enjoined to lie on the back, the pelvis being elevated, and the knees flexed. Or, in other words, the abdominal muscles must be relaxed, by posture, as much as possible. Warm fomentations are to be disposed over the region of the mouth and neck of the sac; and the tumour, if it be a scrotal hernia, supported, or never allowed to be pendent, thus dragging on the neck and mouth of the hernial sac by its own weight. The lower bowel may be induced to empty itself by administering an enema of warm water with a long flexible tube, and tincture of opium should be given in doses suitable to the condition of the patient. It is desirable, however, that a full dose be given, and with this view, thirty drops diluted with camphor-mixture is not too large a quantity. A few hours may be allowed to pass away in order to afford time for this treatment to take effect, unless urgent symptoms arise.

Some patients cannot maintain the posture just described, or it might be highly injudicious to enforce it. The principle of relaxing the abdominal muscles may then be carried out by allowing the patient to lie on the side of the trunk; but even then the hernial tumour must be carefully supported.

Under the influence of this treatment the patient very often falls asleep, and on awaking finds that the protrusion has returned into the abdominal cavity. Now, should that happy result not have occurred, it will be desirable to manipulate the tumour, gently, which perhaps has become soft and flaccid. This must be done

upon some fixed principle. A successful issue will not accrue unless the pressure employed be directed with intelligence. The anatomical relations of the protrusion with the mouth of the sac and the apertures in the abdominal walls must be carefully considered; and the course or direction which the hernia takes in its descent should be strictly regarded in all efforts undertaken with a view to its reduction. The patient must be disposed in a posture to relax all the abdominal muscles which can in the slightest degree contract around the mouth of the sac. This part of the sac and its neck should be fixed, as far as practicable, with the fingers of one hand, whilst the fundus of the tumour is held in the palm of the other. This proceeding can only be adopted when the tumour is large. The object desired by the manipulator is twofold. First, to dilate the mouth of the sac; and secondly, to diminish the bulk of the protrusion. The area of the orifice of the sac may be enlarged by employing the widest part of the body of the tumour as a fulcrum, over which the tissues composing that part of the sac may be stretched. If an enterocele be under treatment, the size of the protrusion may be diminished by partially emptying the tube of its contents; perhaps by relieving the congested blood-vessels: and, in some cases, the tension of the sac is lessened by pressing the serous effusion it may contain into the peritoneal cavity. That fluid being thus disposed of, the operator is enabled to exert a more direct influence upon the hernia.

2. During the stage of vomiting. It behoves the Surgeon to be always on his guard in the use of the taxis, when vomiting is coincident with a hernial protrusion. The longer the time, indeed, the vomiting has lasted, the greater the risk in manipulation of the tumour. If before the commencement of vomiting delicacy of handling be important, how much greater now is the necessity for gentleness when the state of the protrusion, as indicated by the symptoms, can be foretold! Before vomiting occurred, the tissues of the bowel were comparatively healthy, and the damage inflicted by pressure induced a morbid state. After vomiting, especially if it has been persistent some hours and it has become fæculent, the tissues have been rendered morbid by the constriction to which they have been subjected. Ill prepared, then, are they now to resist pressure, and the effect of violence will surely be to bruise or lacerate them.

The measures which were employed in times past to enable the Surgeon to apply the taxis with more effect, and which were generally prescribed at this stage of a case of hernia, need no more than

simple mention here. An exception may be taken in favour of opium. There is one period at which its administration is attended with decided advantage. After carefully watching cases of strangulated hernia, we believe we have correctly noticed that there is a short interval of repose which continues until regurgitation takes place from the small intestines. This occurs when the stomach is empty, as the result of vomiting two or three times. If this moment be seized, and a full dose of opium in solution, with a little stimulus, be administered, the hernia may sometimes be reduced by the taxis. But when once the vomiting of regurgitated fluids is an undeniable fact, the inward administration of medicines is pernicious.

We believe the statement to be correct, that all other modes of treatment have been abandoned in favour of the administration of chloroform. Why? it may be asked. An analysis of the effects of those therapeutic agents formerly in vogue shows that they exerted an influence over the constitutional and local causes preventing the reduction of the hernia, similar to that which is now accomplished by chloroform more speedily, more certainly, with less risk to life, and under circumstances much more within control. The constitutional remedies were bleeding, the warm or hot bath, and tobacco-enemata; all of which exert a powerful but uncertain influence over the vascular, nervous, and muscular systems; on which account they cannot be employed without some risk arising from effects which are often uncontrollable and persistent for a longer period than is desirable. But the anæsthetic qualities of chloroform, together with the complete suspension of all voluntary muscular action induced by the inhalation of its vapour, renders this therapeutic agent of inestimable value, especially in those cases in which the abdominal apertures are under the influence of muscles controlled by the will, as well as stimulated to involuntary contraction by local irritation.

It is especially beneficial in all kinds of inguinal hernia. Its good effects are most striking in cases of hernia into the vaginal process of the peritoneum occurring in infants and youths, as also in those varieties developed slowly in adult life, and which have existed many years. In fact, the operation for the liberation of a strangulated inguinal hernia in middle age and elderly adults, is now rarely required in comparison with the frequency of its performance in past years. As soon as voluntary muscular contraction ceases, under gentle and well-preconcerted pressure, the tumour gradually becomes softer or less elastic, smaller and of different shape, until at

last the hernia escapes from the embrace of the mouth of the sac with a sudden jerk.

The sensation the Surgeon experiences when it quits the sac and enters the peritoneal cavity is very peculiar and striking. So characteristic is this of the complete freedom of the bowel from constriction, that in its absence the expert Surgeon immediately suspects that all is not quite right.

Usually, vomiting ceases after the reduction of the hernia at once. Occasionally, however, it may continue from the effect of the chloroform alone; but the pain in the abdomen is immediately less, and quickly ceases altogether, especially that characteristic, dragging, pain across the mesogastrium.

The patient should maintain the recumbent posture for a short time, with the abdominal muscles relaxed. We do not consider it necessary to place a pad and bandage over the mouth of the sac. Diet of a bland nature and semi-fluid consistence may be allowed in small quantities, and all stimulation of the alimentary canal by aperient medicine must be avoided. As soon as the injured viscus has recovered its functions, the bowels will act spontaneously. Stimulants should be administered according to the constitutional depression existing at the moment.

But great caution as well as discretion are necessary qualifications on the part of the Surgeon when he manipulates the tumour. During the insensibility of the patient, there is considerable risk of bursting the intestine or lacerating the hernial sac. For twelve hours, or even perhaps for twenty-four, after the first vomit, the danger of using the taxis with sufficient violence to burst the bowel is not very great; but so much damage may be inflicted on its tissues as to preclude all hope of the repair of the mischief. When twenty-four hours have expired, during which time the bowel has been strangulated, it may be very easily burst by forcible pressure, especially if during the latter part of that time the patient has been vomiting fluids which have regurgitated into the stomach from the small intestines. If there be hiccough, the taxis is inadmissible.

The indications of burst bowel are very characteristic. If an enterocele, the hernia glides away from the pressure of the finger, and consequently the tumour disappears. This act is not, however, accompanied with that sudden and peculiar sensation which the replacement of an unburst bowel within the peritoneal cavity produces. The patient immediately complains of severe pain in the abdominal region; vomiting ceases, but retching and hiccough

may arise instead; collapse rapidly supervenes, and death closes the scene in a few hours. In some instances inflammation and suppuration have taken place in the sac, and extending to its coverings, an intestinal abscess has been developed. A fistulous opening thus becomes established, which communicates with the interior of the alimentary tube. (See preceding remarks on Artificial Anus.)

There is a period, then, "when the symptoms of the rupture have gone very far, that it is imprudent to reduce it, even if possible; but as it is impossible, perhaps, to tell when the mortification of the gut is gone too far for reduction, it will, in general, be attempted while life exists, with the hopes of a cure. Upon the other hand it may be asserted, or supposed, that if it is not reduced, that the person must also die; but this is not so certain as the other; for the mortification of a gut simply does not kill—it only kills from its consequences; and there is a material difference between a mortified gut out of the belly, and one within. The consequence of one within is absolute death; but the one without in general endeavours at a cure, by producing inflammation and suppuration of the parts, which is producing a fistulous orifice, or artificial anus."*

Cold applications. Considerable advantage attends the application of cold over the tumour. But when either ice or freezing mixtures are used, their action must be widely extended over the mouth, neck, and body of the sac. The local effects of cold are to diminish the bulk of the protrusion, by exciting contraction of its blood-vessels; to retard inflammatory processes; and, by reducing nervous sensibility, to permit an advantageous manipulation of the tumour. Frigorific applications are valuable agents when there may be unavoidable delay in obtaining chloroform, or in liberating the bowel from constriction. The moment for their employment is after vomiting has commenced, and we consider they are more suitable to cases occurring in the adult than in the earlier periods of life. The advantages attending their employment, however, are so trifling in comparison with the injury certain to be inflicted on the bowel by prolonged constriction, that it is safer to proceed at once to its liberation by operation, than to allow any great length of time to elapse in the expectation of an advantage, in any case doubtful. In practice, cold applications can only be regarded in the light of very useful prophylactics. After marked indications

* *Hunterian Ms. Cat. of the Mus. Roy. Coll. Surg. Eng.*, vol. iii. p. 117.

of strangulated bowel have existed twenty-four hours, cold as a local therapeutic agent is scarcely admissible as a rule, on account of the delay which must necessarily occur at this important moment.

The distressing thirst, an accompaniment of continued vomiting, is greatly allayed by taking small pieces of ice into the mouth.

The introduction of every kind of purgative medicine into the stomach must be scrupulously avoided in all stages of strangulated bowel. When swallowed, they are usually speedily vomited; and therefore it is sometimes suggested that under these circumstances they cannot produce a bad effect. This, however, is not always the case. We have seen fatal results ensue from diarrhœa quickly supervening after the bowel had been reduced, the exciting cause of which was referable to repeatedly swallowing purgative medicines during the stage of vomiting.

A purgative enema seems to exert a beneficial effect occasionally. But after one has been used in the early period of the attack, a repetition of this treatment is perhaps hurtful in the majority of cases.

Many other local and constitutional remedies have been employed with the intention of assisting the reduction of a hernia, and with occasional benefit. But the uncertain result which attends their employment; the disease, which is always progressive in the herniated viscus; and the risk to life, a certain accompaniment of continued strangulation of the hernia and its attendant consequences, —deter the experienced Surgeon from persisting in entertaining the hope of reducing the protrusion by the taxis, after chloroform has been fully administered, and the hernia remains unreduced.

Herniæ have been replaced whilst completely reversing the ordinary position of the trunk, by keeping the head nearest the ground and the pelvis upwards. A patient may be placed in this posture (head downwards) by hanging over the back of a man, or over the side of a high bedstead or sofa, whilst the knees are at the same time flexed. Another method consists in encircling the mesogastrium with a folded sheet or round-towel, and at the same time drawing the contents of the pelvic region from below upwards, whilst the patient lies in a recumbent posture.

When the hernia is but recently strangulated, and it is an object to reduce it as speedily as possible, without a cutting operation, any method suggested which has been once successfully employed is perhaps worthy of a trial.

Injuries inflicted and accidents occurring in the use of the taxis. These affect the following structures, separately or in combination; but we may consider independently—

Those affecting the hernia ; those affecting the sac ; and those involving the tissues covering the sac.

The hernia, whether consisting of a hollow or a solid viscus, may be bruised, and its blood-vessels ruptured. Under these conditions blood is extravasated into the tissues composing it, producing either patches of ecchymosis, or, when an enterocele exists, layers of effused blood appear between the different coats of the viscus.

The tissues of the bowel being most delicate, they are more commonly subjected to irreparable injury by violent taxis than the omentum. The presence of this structure, perhaps, often tends to prevent the serious mischief just described. The degree of irreparable injury inflicted on the bowel cannot be accurately estimated by the length of time the symptoms of strangulation have existed. Much rather does it depend upon the violence and prolongation of the attempts employed in the taxis. At any moment during the first twenty-four hours succeeding the first act of vomiting, the entire portion or coil of bowel in the sac may be so disorganised by pressure that its vitality is entirely destroyed, and so literally killed that nature throws off the part by the processes usually attending the separation of living from dead tissues. Under these circumstances, the entire calibre of the canal is divided, and an artificial anus is formed ; or death takes place in consequence of extravasation of the stercoraceous material into the peritoneal cavity. Sometimes the tissues of the bowel are cut by pressure against the orifice of the sac, or the structures surrounding it ; as in femoral hernia, against the free edge of Gimbernat's ligament.

After the expiration of twenty-four hours, the constriction to which the bowel has been exposed having led to inflammatory effusion into and softening of its textures, there is great risk of bursting the tube. This rent usually occurs at the convex border of the gut, at the furthest point from the mesentery, and corresponds with the direction of the circular contractile fibres.

Another effect of violent compression is to cause the mixture of blood and coagula with the serum in the sac, and flakes of lymph or puriform effusion arise from the same injurious interference. The local and constitutional indications of these injuries have been described in a preceding page.

Injuries of hernial tumours by accidental violence. We may here briefly describe the treatment of those injuries which happen to hernial tumours from accidental circumstances, during the pursuit of the ordinary avocations of individuals afflicted with reducible as well as irreducible ruptures. The reader will derive more information on this subject than it is possible to introduce here, by the perusal of a most interesting paper, entitled "On the proceeding to be adopted in a case of injured intestine from a blow on a hernial sac," by the late Mr. Aston Key.*

A simple contusion is the mildest form of injury. Should the signs of more severe mischief be absent, the hernia may then be returned. It is important, however, that the patient abstain from bodily exertion, and the alimentary canal be kept in a state of repose. If the violence of the blow have been sufficient to cause inflammation and ulceration of the gut, the slightest indication of any such secondary mischief must be watched with the most anxious care, and the favourable moment seized when an incision into the tumour will allow the escape of the contents of the alimentary canal, and by this proceeding avoid the risk of extravasation into the peritoneal cavity.

But when there are plain indications that the primary effect of the violence has been to lacerate the intestine, which by chance was contained in the sac at the moment the injury was inflicted, time should not be wasted in adopting palliative measures ; but the hernial sac must be freely cut open, and thus a ready means of escape be made for the stercoraceous fluids. The

* *Guy's Hospital Reports*, 1842, vol. vii. p. 261.

symptoms indicating a wound of the intestines are described in vol. ii. pp. 411 et sqq.—RUPTURE OF THE INTESTINE.

Another variety of injury of a hernial tumour is when the patient has an irreducible epiplocele. The omentum is adherent to the mouth of the sac, and entirely blocks it up, plugs it as it were, whilst the body of the sac remains as a simple closed serous cavity. A contusion of such a tumour excites inflammation and suppuration within the sac. Considerable embarrassment may be experienced in precisely diagnosing the exact nature of the disease.

Injuries of the hernial sac. There are two varieties of injury which produce important effects on the sac containing the hernia. Both of them render a case of strangulated hernia exceedingly complicated and embarrassing. The violence causing the mischief may be applied to the tumour either by the sufferer or another person; but considerable force is requisite to rend or tear the tissues composing the sac, or to separate it from its surrounding connexions. These injuries more frequently happen in association with long-continued pressure than after short trials of the taxis. The two varieties are as follows:

A. *By displacement.* The sac is detached, to a greater or less extent, from the surrounding structures. Those parts of the sac called the orifice and neck are more frequently affected by this injury than any other portion. They become detached from the inner surface of the internal abdominal fascia. Together with these, that portion of the parietal peritoneum immediately circumjacent to the sac's mouth is also severed from its attachments, and in this manner a pouch is formed within the fascial membrane of the abdomen, into which the hernia may be forced; and being retained therein, is lost to touch and sight. Sir Charles Bell has recorded a case which illustrates this injury.*

It is stated that the entire hernial tumour may be pushed within the abdominal walls, in a mass, whilst the hernia is still strangulated by the orifice of its sac. This injury was first described by French writers, under the appellation of "*réduction en bloc*." However, more recently, examinations made after death indicate other lesions to be the probable causes of the disappearance of the hernia, in some cases; and certainly afford conclusive evidence that such an accidental disposition of the sac, when strictly examined in an anatomical point of view, must still be regarded as a very rare occurrence indeed. We refer the reader to Mr. Luke's paper for further information.†

In offering the following explanation of many of these cases, we court the inquiry of future observers, to develop its correctness or to prove it to be erroneous. The tissues of the scrotum are very loose, and readily change their position. Every observer must have noticed the variable length of the spermatic cord, between the external abdominal ring and the testis, at different times. The hernial sac, attached to the anterior surface of the spermatic cord, also varies in length in like manner. When the hernia occupies the sac, the latter extends lower than when it is empty, in which last state it perhaps only just emerges from the inferior outlet of the inguinal canal. Now let its mouth and neck be detached from the internal abdominal ring, and the hernia still strangulated by the margins of the orifice be pushed inside the abdominal walls. The fundus of the sac attached to the tissues of the scrotum is not on this account severed from those connexions, but merely ascends towards the inguinal canal, and lies partially within it with its walls in close contact, which, being rather thin, are not very recognisable. The fact that this part of the hernial sac has been often found in this situation during the progress of an operation for the liberation of the strangulated gut, is attested by the reporters of those operations.‡

* *Lond. Med. Gaz.* 1828, vol. i. p. 485.

† *Med.-Chir. Trans.* 1843, vol. xxvi. p. 159.

‡ *Ibid.* 1859, vol. xlii.; see tables at end of paper, p. 278.

B. By laceration or bursting. As the effect of forcible and long-sustained compression of the hernial tumour, the delicate serous membrane of the sac is rent, burst, or torn, and the hernia makes its escape through the aperture into the subserous connective tissue. Its course outside the peritoneal sac is promoted by continued pressure; and detaching the connexions of the neighbouring peritoneum, it forms for itself a lodgment between that serous membrane and the internal abdominal fascia.

The part of the sac a little below its abdominal orifice or mouth, usually styled the neck, which lies in the inguinal canal, is most frequently burst along its posterior surface. This injury is more commonly produced in that variety of inguinal hernia, the sac of which is constituted of the vaginal process of the peritoneum, whether the hernia be in contact with the testis or not. It is inflicted with remarkable facility when the patient is fully under the anæsthetic influence of chloroform, especially if he be also youthful. This accident is easily imitated, after death, upon a subject in which the neck of the hernial sac happens to be rather long, by cutting an opening in its posterior wall, and pushing the finger in a backward direction. The course which the finger takes is that one which the hernia would pursue.

The indications of the accident having taken place are as follows: the tumour becomes flaccid, and therefore smaller, which alteration in its features is probably owing to the serum which the sac contained being squeezed through the rent into the connective tissue around the sac; the bulk of the tumour slowly diminishes as the pressure is continued, until at last very little if any thing can be felt, but the Surgeon has failed to experience that sudden jerk so characteristic of the escape of the hernia from the gripe of the mouth of the sac, as it enters the abdominal cavity; and if he have had much experience of the reduction of hernial protrusions, doubts will arise in his mind as to the probable direction this one has taken. After the effects of the chloroform have passed away, all the symptoms of strangulated bowel recur, and perhaps with increased force. Even the tumour itself may reappear, and recede on the application of slight pressure.

Now all these circumstances are highly characteristic of the accident that has occurred; and there remains but one proceeding to be adopted immediately. It is this. The hernial sac must be exposed and opened. Perhaps it may appear to be empty; and even the finger passed upwards and along the inguinal division of the sac enters a cavity through a well-defined aperture, in which intestine is felt. This abnormal aperture may be mistaken for the internal ring and the cavity into which it leads, that of the abdomen. Acting upon this belief, however, would lead to the commission of a fatal error; one which, if not detected at the moment, will surely compromise the life of the patient. An effort must now be made to draw the bowel out, if it does not come forth spontaneously; and when this is accomplished, the true mouth of the sac will be discovered by passing the finger upwards along the anterior surface of the mesentery. By the orifice of the hernial sac the protrusion is firmly constricted. The constricting tissues, therefore, require to be cut; after which operation, the exercise of great care and caution is needed to prevent the entrance of the hernia once more into the abnormal space outside the peritoneal cavity. As the salvation of life depends upon the return of the protrusion through the natural orifice of the sac, considerable freedom in the use of the knife is justifiable, if the attainment of the desired end is thus facilitated, and the risk of failure in doing this thereby removed. All cases of this description not only give rise to great embarrassment and difficulty, but they are also associated with very unfavourable consequences and results.

Injuries to the coverings of the hernial sac. A very short description will suffice to indicate the nature and effects of the injuries inflicted on the tissues covering the sac by the use of unjustifiable violence in attempting to reduce a hernia by the taxis. We have seen the results of contusion; namely, ecchymosis of the integuments; extravasation of blood and cedematous infiltration into the subcutaneous tissues covering the sac; and inflammation of all the

structures together, passing on to suppuration, sloughing, and phlegmon, extending to the neighbouring regions. Those local morbid conditions require the ordinary topical measures suited to them.

The disappearance of the hernia in consequence of its passage from one sac into another;—intra-parietal. We may here allude to those rare cases of inguinal hernia which are complicated with an intra-parietal sac. Anatomically examined, the hernial sac in these cases consists of two parts; that division which passes along the inguinal canal into the scrotum, and that one which is lodged in the walls of the abdomen. A full description of these curiously developed sacs is given in the section of this paper devoted to inguinal hernia. Now when the hernia is strangulated by the ventral orifice of the sac, and it occupies the scrotal division, it may be pushed by the taxis, even when employed with the utmost care and skill, into the other sac, and thus, the tumour disappearing, the Surgeon considers the hernia reduced. The constitutional symptoms, however, quickly indicate that this is not the case. By inducing violent action of the abdominal muscles, or making the patient stand erect, the hernia will sometimes again appear. Under any circumstances, the liberation of the bowel is demanded, and in the necessary operation to accomplish this end great care is required to avoid passing the bowel from one sac into the other, instead of into the abdominal cavity.

The operation for the removal of the impediment to the reduction of the bowel, or the liberation of the hernia. The culminating point in the treatment of every case of strangulated enterocele, is reached when the impediment to the reduction of the bowel must be removed by a cutting operation. This of course occurs after the failure to reduce the protrusion by the taxis.

The part of the practical Surgeon is not only to know truth, but to apply it; and, however repugnant to the feelings of the patient, or creative of alarm the thoughts of an operation may be, it is his paramount duty to urge concurrence in this step, as it alone offers the surest prospect of the salvation of life.

By too many medical men the cutting operation seems to be regarded in the light of a last resource, and one which it is improper to use until the danger to the life of the patient appears imminent. But the sooner that this fatal error is eradicated, the sooner shall we discover upon what fallacious views it has been based. We believe that death resulting from strangulated bowel would be a rare occurrence, if it were practicable to return every strangulated enterocele within twelve hours after the commencement of the symptoms, even assuming that the cutting operation be required to accomplish that end in every case. For let this conviction be firmly impressed upon the mind, that death results not from the operation, but because the operation was not performed at the right moment.

Every medical attendant upon a case of strangulated hernia should reflect on these indisputable facts, that so long as the viscus

remains in that condition the life of the patient is slowly ebbing; that to his judgment and foresight has been committed the safety of the sufferer; and that upon his discretion, firmness, and resolution hangs the fatal issue. For it is no exaggeration to say, that each minute as it elapses carries with it the chances of recovery further and further away.

We hope that the mortality arising from strangulated hernia is not now so large as it once was.* Nevertheless, at this moment it is excessive; and when we know, and all professing surgery should know, how surely the liberation of the bowel tends to save the life of the patient, why is it not done the moment all other measures have failed to replace the gut in the abdominal cavity? Some medical men do not seem to be sensible of, or to appreciate the vast amount of injury which is certain to accrue from the persistent vomiting, nor to value the indications derivable from the character of the vomit. They most assiduously attempt to check the vomiting by administering medicines; but they utterly reject, at the suitable moment, the only means by which it is to be arrested.†

The operation, kelotomy, herniotomy. The first part of the

* Mr. Hey states, that when he entered upon the profession of surgery, now 100 years since, "the operation for the strangulated hernia had not been performed by any of the Surgeons in Leeds;" and he adds, that he "lost three patients in five upon whom the operation was performed." *Practical Obs. in Surgery*, 3d edit., 1814, p. 129. Are the results of the treatment of strangulated hernia more successful at the present day? We fear not.

† We may have expressed our views a little strongly, and thus laid ourselves open to criticism and animadversion; for we confess to have been a little influenced whilst writing these lines by an occurrence which took place at the time of doing so. A fine woman for her age, which was seventy-one years, known to be the subject of strangulated femoral hernia, was allowed to vomit persistently for between ten and eleven days. At this time she was sent to the hospital "for the operation," which necessitated a journey of several miles. She arrived cold and pulseless, though intelligent; the abdomen was tympanitic: she was in fact moribund. As soon as practicable the liberation of the bowel was effected. The escape of purulent fluid from the abdomen was sufficiently characteristic of the condition of the peritoneal cavity. In spite of warmth applied to the surface of the body and stimulants administered internally, she expired in a few hours after admission. Yet, during the ten days preceding, medicines had been prescribed to arrest the vomiting, taxis had been frequently employed, and the marvel was, as a friend who accompanied her expressed it, that she reached the hospital alive. What other result than death could have been anticipated? *Ten days' vomiting*, and starvation for the same period, was surely enough to destroy life at the age of seventy-one years; but, in addition, she had a perforating ulcer at the point of junction of the upper division of the alimentary canal with the hernia, extravasation of stercoraceous matter, and diffused peritonitis. Nor is this case an isolated example of culpable negligence. Instances already recorded in books, and abundantly exemplified in the weekly medical journals, abound in the metropolitan and provincial hospitals. Such misfortunes—for we deem it to be a misfortune that hospital Surgeons have to treat cases of this kind—would never occur if the medical attendant could but be made to feel that his patient lies within the jaws of death until the intestine is returned into the peritoneal cavity.

operation consists in cutting through all the tissues covering the hernial sac, carefully recognising their characteristics as they differ in the special regional varieties of hernia. Having reached the sac containing the strangulated viscus, the operator now determines upon the propriety of opening it and exposing its contents to sight and touch.

If he determine to cut the sac open, it should be done in this manner. The body of the sac is nipped up between the finger and thumb, and with exceedingly great care, to avoid at the same time including the walls of the bowel. An opening, sufficiently large to admit a grooved director, is next made with a scalpel, the sharp edge of which must not be directed towards the contents of the sac, but laterally. The side of the blade should be placed nearly flat on the tumour. By this management of the instrument, all risk of injuring the intestine is removed. A grooved director having been passed through the opening and firmly held against the inside of the sac, rather indeed stretching its tissues over it, they are freely divided, upwards and downwards, or towards its orifice and fundus.

Usually the escape of more or less serum is a sufficient indication that the hernial sac has been opened. But the operator should not be thrown off his guard by an absence of serum, when the sac has been cut, any more than by seeing a flow of fluid when it has not been even reached. The latter somewhat rare occurrence is due to the development of a cyst upon the hernial tumour, and is at once explained by passing the finger into a circumscribed cavity. For the variable conditions of the serum, see page 254.

When an enterocele is under treatment, the intestine is brought into view as soon as the sac is opened; but in an entero-epiplocele it often happens that the omentum only is exposed. The Surgeon then carefully raises this structure, for the bowel lies underneath it in the majority of cases. It is wholly enveloped by it in some instances, when that arrangement termed an omental sac exists. In this case the omentum requires to be carefully unravelled. We employ the last word in order to insure the use of much care and caution in the division of its tissues.*

The condition of the bowel should be now carefully ascertained, for by the morbid state of its tissues the Surgeon determines upon the propriety of placing it within the peritoneal cavity, or allowing it to remain outside of the abdomen. Simple adhesions of the bowel

* A very interesting paper on these "omental sacs," written by Mr. Prescott Hewett, is published in the *Med.-Chir. Trans.* 1844, vol. xxvii. p. 282; and another, on a case of scrotal hernia, with compound omental sac, in *Path. Trans.* vol. iii. p. 98.

to the body of the sac may be gently broken down; but the greatest caution is required in this treatment of the hernia where it lies within the orifice of the sac, as by rough manipulation its tissues may be torn, when extravasation of the contents of the tube into the peritoneal cavity will take place. If the bowel is ruptured, it must be confined to the edges of the wound by sutures.

To reach the impediment to the reduction of the hernia, the point of the index-finger is now directed upon the anterior surface of the mesentery, towards the mouth of the sac. Should the end of the finger pass freely through the ventral orifice of the sac into the peritoneal cavity, when introduced with great gentleness, an attempt may be made to reduce the hernia without cutting this part of the sac. In the manipulation of the bowel great delicacy is required. The Surgeon gently presses the distended coil, and if its fluid or gaseous contents escape into the continuity of the canal, it soon becomes flaccid. This condition may be regarded as an indication that the protrusion is reducible without cutting the orifice of the sac. On the contrary, if after delicate and continued digital pressure the knuckle of intestine continues to be tense, elastic, and round, the Surgeon decides to enlarge the mouth of the sac by cutting it. Operators with little experience would do well to make use of a grooved director. This instrument is carefully passed upon the anterior surface of the hernia, its direction being guided by the index-finger of the left hand. It should be introduced into the abdomen sufficiently deep to be entirely clear of the constriction formed by the tissues around the protrusion, but not further. Careful examination is necessary at this step, to ascertain that the bowel does not overlap the borders of the director, nor lie between it and the anterior region of the neck and orifice of the sac. To avoid all risk of injury to the bowel, when that viscus is quite clear of the groove in the director, the instrument should be firmly pressed against the tissues which are about to be cut. A bistoury, specially constructed for this operation, is gently glided along the groove on the director, and a slight resistance is usually encountered as it passes through the constriction, which, however, yields as the cutting edge reaches, and in its passage divides, those tissues which cause the impediment to the reduction of the hernia.

When those tissues are firm and rigid, a sound is produced, or a peculiar sensation is felt, on dividing them, resembling the cutting of thick leather. The operator now employs the index-finger to examine the opening he has made. If it feels sufficiently large to admit the passage of the hernia, he next attempts its reduction;

if it prove still too contracted, the bistoury may be passed along the finger and the incision increased. The impediment to the reduction of the hernia being thus entirely removed, its replacement within the abdominal cavity is easily effected.

The following, then, are the principles upon which every step of the operation must be based: minute anatomical knowledge; the exercise of deliberate consideration and judgment; the recollection of the necessity for practical care, delicacy of manipulation, and of the importance of interfering as little as possible with the surrounding structures. Just so much must be accomplished as is absolutely needed, and no more.

But we must revert to a few subjects merely alluded to in the preceding description of the operation.

Of opening the hernial sac. When the anatomical relations of the hernial sac were carefully examined, it was discovered that the impediment to the reduction of the hernia was not in all instances caused by the narrow passage of the ventral orifice of the sac alone. Careful dissections showed that those structures which lie in close connexion with the outside of its mouth and neck offered considerable obstruction to the retrograde passage of the hernia through those parts of the sac.

For the last hundred years Surgeons of eminence have applied these anatomical facts to treatment, and many distinguished operators have dwelt upon the advantages to be derived from replacing the hernia in the abdomen without cutting open the peritoneal sac. On the grounds above alluded to, they have devised that mode of performing the operation for a strangulated enterocele called "the division of the stricture without opening the sac," or "external to the hernial sac."

The advocates of the operation believe its most favourable points to be as follows: the peritoneal cavity is not opened; the peritoneum at the mouth of the sac is not cut; the diseased intestine is not exposed to the influence of the atmospheric air, nor to the direct contact of the fingers of the operator; nor is the risk of hæmorrhage into the peritoneal cavity so great, should a large vessel be accidentally cut. They consider, then, that the operation itself is not attended with the same amount of danger as when the peritoneal cavity is opened, its parietal reflection cut, and the inflamed bowel exposed.

The simplicity of the proceeding commends the operation highly; for the wound inflicted is very little more than an incision through the integuments, and its advantages must have seemed paramount at a time when the dangers of the operation were exaggerated, and it was assumed that patients with strangulated hernia died from the effects of the operation itself.

Bearing in mind, however, that death occurs from the constitutional and local effects of long-continued strangulation of the bowel and its injury by forcible taxis, and because the bowel is not liberated by the operation early enough, the advantages of any particular mode of operating, especially of this one, are perhaps not quite so great as at one period many Surgeons were inclined to admit. The method of performing the operation is quite a secondary consideration, in comparison with the importance of the early liberation of the bowel.

The opponents of this operation enforce their objections with the doctrine that, when the necessity arises for any cutting operation at all, the fact alone is sufficient to demand an incision into the hernial sac, in order to ascertain the cause of the impediment to the reduction of the hernia; and that an operation for the liberation of a strangulated bowel is not complete until that viscus has been carefully examined. They also regard the risk to be

great of reducing the hernia, still strangulated by adhesions, omentum, or even by the orifice of the hernial sac itself.

Next, pointing to statistical facts, and comparing the results of the two operations as performed in different metropolitan hospitals,—in those where the preference is given to opening the sac in all cases, and in those in which the opposite plan is pursued,—they maintain that the greatest success is obtained at those institutions where the sac is incised as a rule.

It is, however, quite clear that we are unable to collect any facts upon which to institute a safe comparison. Conclusions as to the success of the one practice or the other, based upon the results of the cases under treatment in the hospitals, are really worthless, because the incidents in any two cases of hernia are never precisely alike, and accuracy, as to details, which is absolutely required to arrive at the truth, cannot be obtained.

We believe the dictum to be equally erroneous, when one Surgeon says that in every case the sac must be opened, and another directs that it must not, except by compulsion. The proper practice consists in making a judicious selection of the cases: viz. those in which the operator opens the sac upon a fixed principle; those in which he does not, because, according to his judgment and experience, there is no necessity to do it.

In many of the metropolitan hospitals the operation external to the sac is performed in suitable cases, upon conviction of its advantages; and although we dare not venture to say that some of the fatal cases which have occurred after opening the sac might have terminated differently had it not been incised, we do not hesitate to affirm, that the untoward circumstances stated as likely to happen, when the sac is not opened, have not occurred.

Doubtless every hospital Surgeon to whom the opportunity occurs of frequently operating on cases of strangulated hernia, will be guided by his own judgment as to the propriety of opening the hernial sac in every case, or of leaving it intact in selected cases. But if we may be permitted to enunciate the principle upon which inexperienced Surgeons may act with safety, it would be this. In all those cases in which the Surgeon would deem it safe to return the hernia by the taxis, if it were practicable, he may do the same thing after he has removed the impediment to the reduction of the hernia, by cutting those tissues lying outside the sac which are the cause of that impediment. But in those cases in which the symptoms are suggestive of an aggravated morbid condition of the bowel, and on account of which it would be improper, nay hazardous, to attempt to reduce it by the taxis—in those the sac must be opened.

In making a suitable selection of the cases for the first plan, great discrimination is therefore required. We regard those cases to be favourable for the operation in which the symptoms of strangulation have existed but a few hours, and when they have not been very severe; when the vomiting is not stercoraceous, nor the patient very prostrate; when the tumour is a simple enterocoele, and when it has escaped forcible attempts at reduction. Of course no cutting operation of any kind will be attempted until after the failure of well-applied taxis to reduce the hernia.

On the contrary, the indications for incising the sac are: a

long continuance of the strangulation of the hernia; the persistence of stercoraceous vomiting; the prostration of the patient; the compound conformation of the tumour (it being an entero-epiplocele), and repeated, protracted, or forcible taxis having been used.

Guided by these facts, the number of cases in which the operation of division of the impediment to reduction of the hernia external to the sac may be regarded as preferable to any other, becomes very limited. But we cannot refrain from expressing our conviction, founded upon the results obtained in those cases in which this operation has been carried out, that it is easy of performance, free from the risks attributed to it, unaccompanied by some of those accidents which occasionally occur when the sac is opened, and most favourable to the rapid recovery of the patient. It must, however, be remembered that these are select cases, and belong to a class most favourable for recovery; and we cannot deny but that they would probably be successful, even should the peritoneal sac be cut open.

Nevertheless the inquiry suggests itself, If the hernia can be reduced with safety without opening the peritoneal cavity, why should it not be?

Of the instruments required to perform the operation. They are as follows:

1. An ordinary scalpel, with a single cutting edge.
2. Forceps.
3. A grooved straight director.
4. A grooved director, specially adapted for insertion beneath the tissues forming the impediment to the reduction of the hernia.
5. A bistoury of peculiar construction, with which to cut those tissues.
6. Retractors.

The *director* (4) and the bistoury (5) are the only instruments requiring special notice.

The *director* has been constructed after a great variety of forms—straight and curved; long and short; narrow and wide; with wings or lateral projections to protect the bowel from the knife; with and without a handle affixed; with a probe-pointed end or beak; with the groove terminated, near the end, by a stop, or without such a stop. That form of the instrument invented by the late Mr. Aston Key has been employed under our observation many years with advantage; and we are able, therefore, to recommend its use. It is usually known as Key's hernia director.*

The *bistoury* used to divide the tissues which constitute the impediment to the reduction of the hernia, wherever they may be situated, has been made in a great variety of shapes, lengths, and breadths, and usually with some contrivance, movable or fixed, to prevent its end and cutting edge injuring the intestine. It being impossible to describe every variety of the instrument, perhaps it will suffice to state the characteristics of a good one for safely performing this important part of the operation. It is desirable to have two bistouries at hand, one straight, the other curved. When the ventral orifice of the sac is deeply seated, the latter will be found

* A drawing representing this instrument may be seen in Mr. Key's *Memoir on the Advantages and Practicability of dividing the Stricture in Strangulated Hernia on the outside of the Sac*, 8vo, Lond. 1833; Drawing 1.

very useful. In other particulars the two instruments resemble each other. The metallic part extends about $3\frac{1}{2}$ inches beyond the handle. Its sides are $\frac{3}{8}$ of an inch broad where it unites with the handle, and they gradually diminish towards the end, where the breadth is $\frac{1}{8}$ of an inch. The blade terminates in a button or blunt end. At the terminal $\frac{3}{8}$ of an inch, the sides of the metal are bevelled off, and one edge is made to cut. This sharp edge should be slightly concave. All the other edges and surfaces of the metallic shaft are carefully rounded off and polished. Sir A. Cooper's hernia-knife has a cutting edge $\frac{5}{8}$ or $\frac{7}{8}$ of an inch long, beyond which extends a blunt terminal portion $\frac{3}{8}$ of an inch long. The objection we entertain to this knife relates to this long blunt beak, which must be passed into the abdomen before the cutting edge reaches the tissues which require division.

When the index-finger, of either hand most convenient to the operator, is employed as a director, its point is passed to the orifice of the sac, outside or inside; the bistoury is passed upon the anterior surface of its first phalanx, and the side of the instrument being pressed against it, lies in a depression on its soft parts. Thus the sharp edge of the knife is prevented from injuring the bowel. The end is then dexterously insinuated beneath the tissues to be cut; and as they slowly yield before it, the finger follows the direction of the knife, and the operator judges of the size of the opening he is making by the facility with which his finger passes towards the abdomen.

When a metallic director is used, the bistoury is gently carried along the groove of the instrument.

Of the treatment of the strangulated intestine. The primary object of every Surgeon who has a case of strangulated enterocele under his charge, should be the return of the intestine into the abdominal cavity as quickly as possible. With this object in view, "the operation," as it is termed, is undertaken after the failure of all other means.

But there are certain morbid states of the bowel which preclude the operator from doing this, after the liberation of the viscus from the constriction to which it was subject. The morbid conditions having been already described (p. 250), we need only briefly refer to them here, in order to direct their treatment.

Commencing, then, with the worst condition, in which the entire knuckle of the intestine in the sac is dead, mortified, or sphacelated. Before the operation, adhesions will have formed between the coils of bowel in the abdomen, as well as between them and the parietal peritoneum in the vicinity of the margins of the mouth of the sac. It would be very injudicious interference with the processes of nature to break down these adhesions. They are the result of peritonitis; and this form might be termed protective, for its effects, especially the adhesions, may possibly prevent the extension of the peritonitis, and the mischief which would certainly accrue if the contents of the alimentary canal escaped into the peritoneum.

It is sometimes difficult to find the end of the upper portion of the alimentary tube, from which the stercoraceous matter escapes; meddling with the processes of nature is not desirable,

and therefore, unless the perforated viscus is easily reached, it is better to leave the parts as they are, exposed. The edges of the wound should be left free and open, in order to allow a ready escape for the contents of the bowel. In this manner an artificial anus is established. Should the open end of the gut be accessible, one, two, or more sutures may be inserted through all the structures constituting its walls, and they may be thus fastened to the integuments.

If there be a small perforation in any part of the herniated viscus, the result of disease, there are generally adhesions within the abdomen, which prevent the extravasation of its contents into that cavity. When, therefore, the opening does not involve the whole calibre of the canal, the herniated viscus may be placed just within the abdomen; for sometimes the aperture will entirely close, even after stercoraceous matter has freely flowed through it for several days.

Should the intestine be accidentally wounded, the cut edges may be carefully drawn together by using the glover's suture, and returned just inside the mouth of the sac.

When the tissues of the herniated bowel are not perforated, but appear to be in such a morbid condition as to induce the operator to fear that their restoration to a healthy state is improbable, although just possible, the hernia may be returned. The late Mr. Aston Key advocated this plan of treatment. He did this upon the principle that the abdominal cavity was the place in which the injured bowel was more likely to be repaired than in any other. "The danger of abdominal extravasation will not be increased by replacing the injured bowel at the neck of the sac; for, should sloughing of its coats ensue, the slough may be walled-in by adhesion of the surrounding peritoneum, and faecal extravasation be prevented."*

In some cases the operator encounters great difficulty in reducing the hernia, even after the mouth of the sac has been freely enlarged. This depends upon the following causes:

1. *Its bulk.* The hernia sometimes consists of a very large quantity of intestine, which is distended with flatus; and although a portion is reducible, the reduction of the entire mass is impracticable. After the failure of these attempts, a plan may be pursued which was adopted by Mr. Tatum with complete success.†

The bowel may be punctured, and the flatus allowed to escape.

* *Guy's Hospital Reports*, 1842, vol. vii. p. 264.

† See *INJURIES OF THE ABDOMEN*, vol. ii. p. 435.

Mr. Tatum used a grooved needle for the purpose; we would suggest the employment of the filiform trocar and canula. This instrument may be obliquely inserted through the tissues of the bowel, thus forming a valvular wound.

2. *Adhesions.* These may be *recent* and *chronic*. The latter are often formed long antecedent to the condition for which the operation was undertaken. In the recent state the adherent surfaces are usually easily separated, whether they unite the coils of the bowel to one another, to the sac, or to the omentum. When this morbid condition happens to the viscus *in* the body of the sac, there is not much risk of the interference making mischief; but when the bowel is adherent to the mouth of the sac, the condition usually indicates an advanced morbid state of the viscus. It is an indication that nature has made preparations to prevent extravasation into the peritoneal cavity, in the event of the bowel bursting from the distension caused by accumulations in that part of the digestive tube above the hernia. Meddling with such adhesions is attended with great risk of tearing the bowel. The safest procedure is to reduce the protrusion, if possible, after having enlarged the mouth of the sac; but even allowing it to remain in the sac, relieved from constriction, would be preferable to lacerating the bowel in the attempt to separate the adhesions, and so establishing an artificial anus. Recent adhesions to other structures may be separated with ease. Flakes of adherent lymph had better be left where found. By detaching them, the coats of the bowel may be torn; and they frequently overlie small sloughs.

Enterocoeles of long standing sometimes become permanently united to a part of the sac, although very rarely. In such cases the orifice of the sac is usually large, and the chance of the bowel becoming strangulated proportionally remote. The peristaltic action of the canal proceeds as usual in the hernia, with occasional inconvenience arising from accumulations therein, causing obstruction. Should an operation be required, two proceedings may be adopted: either the orifice of the sac may be enlarged, and the intestine left in the sac; or the adhesions of the viscera may be destroyed, and the bowel returned. The choice of these two plans might be decided by the condition of the viscus and the extent of the adhesions.*

3. *The depth and inaccessibility of the mouth of the sac.* That part of the sac which lies in close relation with the general peri-

* Relating to these cases, the reader may consult *A Treatise on Obstructed and Inflamed Hernia*, by Henry Stephens.

toneal cavity is sometimes so deeply seated, that considerable embarrassment arises, not only in making its orifice larger, but in returning the hernia into the peritoneal cavity when that has been done. By employing an assistant, who carefully holds the opened hernial sac by its cut edges, to draw it forwards and outwards, or from the abdomen, its mouth is more fixed and slightly stretched. This manœuvre greatly facilitates the reduction of the protrusion.

Treatment of the omentum. Omental protrusions or epiploceles rarely require the removal of the impediment to their reduction by a cutting operation. But after the return of the intestine, in cases of entero-epiplocele, it often becomes a question, what is to be done with the omentum.

The treatment is as follows: it may be reduced; it may be left in the sac; it may be cut off; or a ligature may be tied around it.

The first proceeding would be generally chosen when practicable. In some instances, however, the great bulk of omentum, or its diseased condition, necessitate a choice between either leaving it in the sac or removing it.

There are some disadvantages in leaving the omentum in the sac: the fat becomes inflamed; it suppurates, and sometimes sloughs; the healing of the wound is consequently delayed, and the after treatment of the case thereby protracted. Usually, however, the omentum shrinks up and contracts, and eventually the wound heals, but with more or less of a tumour at the abdominal aperture. This swelling may interfere with the successful application of the pad of a truss. Some Surgeons, however, believe the remains of the omentum to be useful in blocking up or plugging the ventral aperture.

The removal of either the whole or a part of the protruding omentum may be effected by cutting it away at once, or by applying a ligature around it near the orifice of the sac, and leaving the portion below the ligature still attached, or cutting it off. Besides, there is the alternative of leaving the truncated end of omentum in the sac, or of replacing it in the abdomen. By the exercise of due care, omental adhesions to the sac may be safely separated, whether recent or chronic.

If the omentum be cut off, there is great risk of bleeding from its cut vessels when it is replaced in the peritoneal cavity. Even after every precaution had been taken to secure the blood-vessels, cases in which omentum has been excised have proved fatal from internal hæmorrhage alone.

It has been assumed by some writers to be injudicious to tie a ligature around the omentum, on account of the untoward results which may ensue. But the reader should refer to vol. ii. p. 433, where he will find the good results of this plan of treatment related by Mr. Pollock, as well as the mode of applying the ligature.

By the kindness of the editor, Mr. Holmes, we are able to give the result of the practice of removing diseased or superfluous omentum, after ligature, as performed at St. George's Hospital. Of twenty cases of hernia in which the omentum was securely tied, a few died; but the notes of the after-death examination of them show the cause of death to have been, in all cases, independent of the ligature placed around the omentum. Of eleven cases in which the omentum was allowed to remain in the sac, many recovered, although abscess and sloughing of its tissue occurred in some of them.

We are informed that in no single instance has any untoward symptom been excited by the ligature of the omentum; and that the truncated portion of omentum filling the orifice of the sac plugs it, and produces a permanent obstruction to the descent of a hernia, quite as completely as when the whole mass is left. The period occupied in the cicatrisation of the wound seemed also to be shorter in the cases in which the omentum was removed, than in those in which it was not.

Cases of double hernia. In patients suffering with a protrusion on both sides of the body, or in different regions, it is sometimes difficult to ascertain which hernia is strangulated. The Surgeon must, of course, employ every means to arrive at a correct diagnosis before commencing the operation. But should he unfortunately have arrived at an erroneous conclusion, and having opened the sac of one hernia find no impediment to its reduction, nor indication of a strangulation, is he justified in cutting open the sac of the other? Certainly. And, as a precedent, we may refer to a case in which M. Dupuytren performed a double operation, and saved the life of the patient. A man, aged 40, was the subject of double inguinal hernia. A Surgeon with much difficulty reduced both tumours. Well-marked symptoms of strangulated bowel existed, although there was no tumour at either ring. M. Dupuytren opened the right inguinal canal first, because the patient complained of most pain when pressed on that side. The sac was empty. He next opened the left inguinal canal and found a hernial sac containing an entero-epiplocele. The orifice of the sac was very deep; it was cut; the bowel returned; and the patient recovered.*

Treatment of the case after the operation. The immediate effect of the reduction of the hernia is usually the cessation of vomiting; especially if the bowel had not been strangulated a very long time, and neither peritonitis nor hiccough had existed before the opera-

* *Leçons Orales*, edit. 1832, t. i. p. 583.

tion. After the employment of chloroform, however, the sickness and nausea induced by the anæsthetic will sometimes continue, when the treatment must be modified accordingly.

Another most striking result of the replacement of the bowel in the peritoneal cavity is the rapid relief from, and entire absence of, pain across the mesogastrium.

It is manifest that no single plan of treatment, to the exclusion of every other one, can be urged as applicable to all cases of hernia, after the liberation of the bowel. As the disease occurs at every age, in every variety of constitution, and under individual peculiarities of the most diverse kind, so strangulation of the hernia may happen with the idiosyncrasies and opposite conditions of youth and senility, strength and decrepitude, health and disease, temperance and intemperance. It must, however, be carefully borne in mind, when treating a case of this kind, that we have to deal locally with an injured intestine, and a penetrating wound of the abdominal cavity; and that the constitutional powers of the patient are greatly reduced by continual vomiting, starvation, suffering, and alarm.

In some youthful, robust patients the tendency to inflammatory action becomes, at an early period, strongly developed; whilst, on the contrary, in the aged and decrepit little disturbance may appear demanding interference.

The after treatment has been conducted upon the most opposite principles. Surgeons of the highest eminence may be found amongst the advocates of the two methods, which may be briefly stated as follows:

In one class are those who administer purgative medicines almost immediately after the operation, and persist in their continuance "until the canal is completely unloaded." Calomel, extract of colocynth, sulphate of magnesia, and castor-oil, are given by the mouth, or aperient enemas injected into the rectum.

Another class, relying almost entirely upon the restorative powers of nature and the influence which repose exerts on the reparation of injured tissues, depends upon diet and, when required, opium.

In selecting one of these plans of treatment for adoption, we give the preference to the last, since it seems to be most suitable to the majority of the cases occurring in hospital practice. In many cases we have allowed the patient to recover without giving any medicine whatever; great care, however, being taken that a mild and farinaceous diet, with milk, be only sparingly taken.

"This necessity for repose," writes Mr. Key, "in an injured state of the bowel it would be well to bear in mind, after the operation for strangulated hernia. The bowel is gorged by the strangulation, bruised by the taxis, as it is too often practised, or inflamed by long incarceration in the sac. An intestine in such a condition cannot but be injured by an early administration of purgatives which irritate and inflame the bowel, or exhaust what little remains of vital energy. After the operation, some time for repose should be allowed before the bowel is called into action: the Surgeon's anxiety to procure stools should yield to the evident necessity for time being allowed for the restoration of the natural powers of the injured bowel."*

Great advantage is sometimes derived from the effects of thirty drops of the tincture of opium, which may be given with a little brandy-and-water, or camphor mixture, soon after the operation.

The bowels are often relieved spontaneously a few hours after the reduction of the hernia; but when they are obstinately inactive, the question arises of the necessity of giving aperient medicines. We have embraced abundant opportunities of comparing the advantages to be gained by the use of purgatives, and by abstaining entirely from their employment. We give the preference to the latter plan, but if the lower bowel becomes loaded, and any discomfort arises from accumulations therein, an enema of warm water, or gruel with common salt or a little castor-oil, or even sweet-oil mixed with it, produces the desired result. Cases under our treatment have progressed favourably, and even the wound has healed, before the bowels have been relieved, and not the slightest trace of inconvenience occurred from the constipation.

When there is much tenderness on slight pressure upon the abdomen, in the neighbourhood of the wound, the local application of leeches is of great service, and it may be repeated as often as required, but in relation to the powers and condition of the patient.

If acute peritonitis be developed, the treatment must be in accordance with the ordinary rules for the treatment of that disease.

Stimulants are often required soon after the operation, and should be given in small quantities. Indeed it is a rule which requires to be enforced, that all aliment must be given in very small quantities, and repeated at short intervals.

If thirst be distressing, pieces of ice placed in the mouth afford great comfort.

* *Guy's Hospital Reports*, 1842, vol. vii. p. 263.

Treatment of the wound. The structures which have been cut and disturbed by the cutting operation should be placed in relation to each other, and the divided edges of the integuments brought together by sutures. The number required may be left to the discretion of the operator, but no more need be used than sufficient to keep the upper two-thirds of the wound united. For it is always advantageous to leave an opening at the lowest end to allow of the escape of blood and discharges. A piece of wetted or dry lint may be laid over the incision, and a pad of folded lint is adjusted over it with a bandage by some Surgeons. However, this is not required in every case, nor is it on any account essential.

If, during the subsequent progress of the case, the connective tissue in the wound, the omentum, or the hernial sac should inflame, the appearance of the integument soon betokens that union by adhesion is hopeless. In that case the lowermost sutures, or all of them, must be removed, and the treatment to be adopted need not differ from that commonly employed in every inflamed, suppurating, or sloughing wound. The grand point is to keep a channel open for the free escape of the discharges.

* *The prognosis of a case of strangulated hernia.* Reflection upon the facts already described will enable the Surgeon to form a very nearly accurate prognosis of a case of strangulated hernia. But in order to concentrate the attention of Surgeons upon those incidents which more especially cause a fatal termination, we must briefly recapitulate the most important morbid conditions which call for special observation.

1. The condition of the tissues of the herniated viscera, and especially of the intestine. Their morbid state is too frequently produced by violence in the use of the taxis, by long-continued constriction, or very tight strangulation of short duration. In such cases, then, the prognosis is usually unfavourable on account of the destruction of the portion of the bowel injured, or of its inability to repair the damage inflicted upon it.

2. The morbid state of the peritoneum, visceral and parietal, and of the tissues of that portion of the track of the alimentary canal between the stomach and the hernia. The existence of peritonitis antecedent to the liberation of the bowel cannot be regarded in any other light than a symptom of grave significance. Associated with it, the alimentary canal above the hernia is usually greatly distended, and its contractile fibres appear to lose their function. These circumstances add to the unfavourable prospects, and lessen the chances of recovery in a very marked degree.

3. The impaired functions of the nervous system. Many patients sink away in the stage of prostration alone. This state of the nervous system is induced by long-continued vomiting, starvation, pain, suffering, exposure, neglect, journeying, purgative medicines, some medicated enemas, the hot or warm bath in some instances, and other measures supposed to facilitate the reduction of the hernia by the taxis. When great prostration, therefore, precedes the reduction of the hernia, it must be regarded as a most unfavourable indication.

4. Neither should we overlook the chronically morbid states of the viscera of the thorax and abdomen, irrespective of the hernia, so commonly existing in the class of persons admitted into our hospitals. Over the influence of

these conditions, however, we can exert but little control, although they form an important element in prognosticating the issue of any case.

5. All these conditions are also influenced by the age of the patient, social habits, general cachexia, and individual idiosyncrasies,—features in a case to which due attention must be given.

Now the lesson that we learn from the study of those morbid states which bring about a fatal termination is this : To return the herniated viscus into the abdomen as quickly as possible ; to accomplish this with the utmost delicacy of manipulation consistent with the requirements of the case ; to distinguish carefully between those cases in which no delay is admissible in liberating the bowel without the loss of a moment, and those in which some means are justifiably employed to assist the taxis ; by acting thus energetically upon sound principles ; by remaining at the bed-side of the patient, or at least not leaving the case until the risk of danger is averted by reducing the intestine,—the Surgeon may hope to rescue from death a very large majority of the cases of strangulated hernia.

The high mortality arising from strangulated hernia is an opprobrium upon the medical art which cannot be removed by any amount of skill or dexterity displayed by the operating Surgeon. The risk of the operation, the mode of its performance, and the subsequent treatment of the case, are merely secondary considerations when compared with the treatment to which the patient is subjected before the operator is called upon to perform his part. All matters relating to the operation only have, perhaps, reached perfection ; but it would really appear, from the condition in which patients are sent into the hospitals to be operated upon, that the greatest amount of ignorance prevails of the principles upon which an irreducible hernia should be treated.*

* Twenty patients who died after the operation had been performed by the author at Guy's Hospital survived the operation as follows :

1	only 17 hours.				
5	survived 24 hours and less than 48 hours.				
4	" 48	"	"	72	"
1	" 72	"	"	96	"
1	" 96	"	"	120	"
3	" 144	"	"	168	"
1	" 168	"	"	192	"
3	survived longer periods, but with artificial anus.				
1	died of bronchitis.				

The causes of death were—

Artificial anus, &c., in . . . 3	Perforation of bowel in . . . 1
Prostration in 5	Bronchitis and cachexia in . . 2
Acute peritonitis in 8	Neglect to seek surgical aid in 1

There can be little doubt that the lives of at least two-thirds of these patients were sacrificed by the delay in having recourse to the operation for the liberation of the bowel ; which, however, was performed as soon as possible after admission.

PART II.

SPECIAL KINDS OF HERNIA.

The following is the classification of abdominal ruptures arranged with regard to the anatomical divisions of the abdomen in which they arise :

- | | | |
|--------------------------|---|---|
| I. In the EPIGASTRIUM | { | 1. Diaphragmatic. |
| | | 2. Epigastric. |
| II. In the MESOGASTRIUM | { | 1. Ventral (also in other regions). |
| | | 2. Umbilical. |
| | | 3. Lumbar. |
| III. In the HYPOGASTRIUM | { | A 1. Above Poupart's ligament ;
inguino-scrotal ; or labial. |
| | | B 2. Below Poupart's ligament ;
femoral. |
| | | C 3. Through the apertures of the
pelvis ; in front—beneath
the ramus of the pubes,
obturator. |
| | | 4. In front—beneath the arch
of the pubes, perineal. |
| | | 5. Pudendal. |
| | | 6. Vaginal. |
| | | 7. Behind—through the ischia-
tic notch, ischiatic. |

HERNIE IN THE EPIGASTRIC REGION.

Diaphragmatic hernia. Of these cases there are three kinds :* first, that in which the diaphragm muscle becomes stretched in consequence of a loss of tone, and is pressed up into the thoracic cavity by the contents of the abdomen ; secondly, that in which, in consequence of congenital defect, some of the viscera pass through the aperture into the thorax ; and, thirdly, when some of the abdominal viscera pass into the chest through the natural apertures in the diaphragm, which have become stretched.

Epigastric hernia escapes in the angle bounded by the cartilages of the first false ribs, the apex of which corresponds to the appendix of the xiphoid cartilage. M. Malgaigne has seen an infant with a tumour in this region which swelled up every time any effort was made with the abdominal muscles. The sac of this hernia is generally more movable than that of an umbilical, and the mouth through which the hernia enters it is usually large. The reduction of the protrusion is therefore easily effected. A suitable bandage is required to prevent the escape of the hernia, which sometimes consists of a portion of the stomach, or arch of the colon and omentum.

* Exclusive of cases in which the abdominal viscera pass into the chest through a laceration in the diaphragm. Such cases are treated of under INJURIES OF THE ABDOMEN, vol. ii. p. 407.

HERNIE IN THE MESOGASTRIC REGION.

Ventral hernia. Of this hernia there are two kinds : first, those which occur in the linea alba ; and, secondly, those which pass through other parts of the parietes, except the so-called rings.

Those of the first kind usually escape in the linea alba between the umbilicus and the pubes. They are produced as the consequence of general relaxation and stretching of the fibrous tissue in the middle line of the abdominal walls after they have been greatly distended during pregnancy or ascites. We have seen hernia follow upon an abscess in which the pus had made its way through at the linea alba. This kind of hernia is more common than the second, which escapes through any part of the anterior or lateral walls.

The usual indications of a rupture accompany these kinds also ; the chief risk of an error of diagnosis arises where circumscribed collections of pus exist in the parietes without much local pain or any constitutional disturbance. If the hernia be reducible, the Surgeon would not be likely to fall into error ; and if not, the history of the case, with a careful manipulative examination, will enable him to form an accurate diagnosis.

Umbilical hernia. By this term we understand that kind of rupture which escapes from the abdominal cavity, either through the umbilical ring in the fœtus, or by an aperture formed at a later period of life in consequence of a separation of the fibres of the linea alba in the umbilical region.

The synonyms are, exomphalos, omphalocele, or, in common language, ruptured navel.

It is developed at all periods of life, and in both sexes. Commonly observed in infancy, it forms a protrusion either before or soon after the separation of the umbilical cord. In youth it is rarely developed, provided that the umbilical aperture has been once well closed. As years advance, it is more frequent, especially in females, and particularly so in persons disposed to obesity.

The hernial sac is always an acquired formation in this rupture ; that is to say, there is not any peritoneal extension at the umbilical ring, in fœtal life, analogous to the inguinal vaginal process of the peritoneum. Nevertheless writers have been long accustomed to divide this hernia into the congenital variety, or that which is so common in infants ; and the acquired, or that variety which is developed in after life.

In infants the protruding viscus pushes before it that portion of the parietal peritoneum lying immediately within the aperture in the linea alba, through which the umbilical vessels enter the abdominal cavity. The hernial sac is thus formed before the closure of the ring is effected, and may pass into the connective tissue of the cord itself, before that structure has separated. We have seen such a case in which the integuments covering the sac sloughed. Rather later, after the separation of the cord, the hernial sac may be protruded in consequence of the umbilical aperture remaining imperfectly closed when it is covered only by the integuments. In youth, a rupture may be developed by escaping through a partially closed ring, which, by continued pressure, it dilates, unless precautions be taken to prevent it. And, in adult life, the fibres of the linea alba become separated by stretching or yielding to the pressure from within, and the rupture escapes at the site of the once closed ring, or in its immediate vicinity. The coverings of the hernial sac are generally very thin, and often inseparably united together. They consist of the integuments ; some fat, which, however, is not often in proportion to the thickness of the layer over the other regions of the abdomen ; and the delicate internal abdominal fascia. The body of the sac is usually very delicate, but it is rather stronger near and at its orifice, around which part the tissues outside of it form a very firm, resisting, unyielding band. The mouth of the sac is often large in proportion to the bulk of the protrusion. The relation which it bears to the tumour when the protrusion is large should be carefully studied. As the bulk of the hernia increases, it does not spread

equally around the ventral aperture upon the anterior surface of the abdominal walls, but it extends downwards towards the symphysis pubis more than in any other direction. In some cases it happens that the transverse diameter of the tumour is greater than the vertical; and occasionally its configuration is so pyriform that the tumour seems to be suspended by a peduncle or stalk. At other times its base is nearly as large as its body; and, again, we may see an almost sessile tumour which, when elevated, is attached by a small stalk, thus resembling a mushroom in shape.

Various organs of the abdomen are found in the sac of an umbilical hernia; very frequently the omentum, the stomach,* portions of the small intestines, and of the large. When the disease has been neglected, we have seen nearly the whole of the intestinal canal in the sac enveloped by omentum. The last-mentioned organ sometimes becomes firmly united to the sac; and when bands or septa are thus produced within it, the intestines may become entangled by them. It likewise becomes hard and contracted, forming masses within the sac which sometimes give rise to difficulty in diagnosis.

This rupture begins by forming a small soft projecting ovoid tumour at the navel. Gentle pressure with the finger pushes something into the abdomen, and a small hole is then felt, with very sharp, firm edges. Directly the finger is removed, the skin either remains relaxed or flabby in the fossa of the navel, or it is slowly projected forwards, and reappears in the same bold relief. If the progress of the disease be not arrested, the protruding viscus descends lower and lower, so that the broadest part of the tumour lies below the mouth of the sac. A curious example of congenital umbilical hernia, coupled with malformation, was shown by Dr. Gibb at the Pathological Society, and in the same volume of the Transactions there is a description of a case of triple umbilical hernia which contained portions of the stomach, duodenum, jejunum, ileum, omentum, and ductus communis choledochus.†

Treatment when reducible. Should there be any disposition to a protrusion at birth, or soon after, the simple application of a bandage is not merely palliative, but materially tends to the cure of the case. In infancy, after the separation of the cord, the protrusion may be prevented by fixing a piece of cork over the umbilical ring. It should be circular, about one inch in diameter, slightly convex on both surfaces, and covered with soft leather. With adhesive plaster to retain it in its proper place, and a bandage encircling the abdomen but not violently compressing it, this plan may be attended with advantage. When the protrusion occurs in an adult, a suitable truss or bandage must be employed, with a view to prevent the dilatation of the sac and the increase of the tumour. If a large irreducible hernia has to be treated, a suitable appliance is required.

The radical cure of this hernia has been successfully effected by an operation performed by Mr. Barwell, on three patients, at the respective ages of 6 months, 15 months, and 8 years.‡ It is, however, open to further inquiry, how far any cutting operation is justifiable in infancy, as so large a proportion of cases are curable by bandages or trusses. Mr. H. Lee states that he has cured cases by inserting needles through the sac, after carefully reducing its contents, and keeping the surfaces in close contact by twisting a ligature over them. Mr. Wood makes use of rectangular pins and the wire suture.

Mr. C. Heath, having been called on to operate in a case of strangulated umbilical entero-epiplocele, after having returned the bowel, dissected the sac from its attachments; and having passed a ligature through its base and the omentum, cut them off. The patient recovered; and when the report was given to the Pathological Society there was not then any hernial protrusion.§ But we are at a loss to understand how the opening in the linea alba was

* A very interesting case is related by Mr. Moore, in the *Med.-Chir. Trans.* vol. xlv. p. 181.

† *Trans. of the Pathological Society of London*, vol. vii. pp. 216, 220.

‡ *The Lancet*, 1861, vol. ii. pp. 419, &c.

§ *Transactions of the Pathological Society*, vol. x. p. 131.

closed by these means; and therefore, until it can be shown that this has been accomplished, we should not recommend the adoption of this measure.

Cases of umbilical hernia offer remarkably well-marked examples of that condition termed obstruction from accumulation of stercoraceous matters, and patients are constantly subject to severe constitutional disturbance arising from this cause alone and not from positive strangulation of the bowel. We should not, therefore, be in a great hurry to operate in these cases; for after a free administration of aperient enemata, the contents of the sac become unloaded, and evacuations from the alimentary canal are obtained.

The operation. An incision should be made in the mesian line of the body, commencing about two or three inches above the upper border of the mouth of the sac, and continued downwards upon the sac as far as may be requisite. The smaller the opening by which the Surgeon can remove the impediment to the reduction of the hernia, or liberate the bowel from constriction, the better; and when it can be accomplished without opening the peritoneal sac, it is desirable to do so. Great caution is necessary whilst cutting the different coverings of the sac; and should it be necessary to cut the tissues forming its orifice, the incision should extend upwards in the same line as the first.

Hernia in the loins. Lumbar hernia has been described by several Surgeons. These protrusions arise after contusions of this region, or perhaps after lacerations of the abdominal muscles in the part, as well as from relaxation of the tissues. In the third *Bulletin des Travaux de la Société de Médecine de Marseille*, Dr. Chapplain* relates the case of a man, aged 60, who, after being squeezed between a wall and a carriage, found in his loin a tumour between the crest of the ilium and the last rib. It appeared at first like a chronic abscess, but the presence of intestine was easily ascertained. Mr. Kingdon saw a case of this kind last year. The bowel protruded just above the crest of the ilium at its highest point, about three inches from the spine, just where the quadratus lumborum and abdominal muscles meet. The man was 54 years old, tall and thin. He suffered with hæmoptysis and emphysema of the lungs.

HERNIE IN THE HYPOGASTRIC REGION.

Inguinal hernia is the most common kind. The statistics of the City-of-London Truss-Society prove this; for rather more than two-thirds of the total number of applicants of both sexes for trusses to support every description of hernia, were afflicted with inguinal ruptures of one kind or the other.†

Of inguinal hernia the following varieties are described: the oblique or external, and the direct or internal. The terms external and internal have

* *L'Union Médicale*, 1862, vol. i. p. 157.

† TABLE B.

Showing the proportions between inguinal and femoral hernia in both sexes, at different ages. (Constructed from Kingdon's tables, 1860-61.)

Ages.	Inguinal.		Femoral.	
	Male.	Female.	Male.	Female.
1 to 20	2435	249	23	38
20 „ 40	2954	322	139	432
40 and upwards	2154	128	144	278
	7543	699	306	748

This table shows—

1. That inguinal hernia is most common.
2. That in females femoral and inguinal hernia occur in about equal proportions.
3. That femoral hernia in the male is the least common of these kinds.

reference to the course taken by the internal epigastric artery in relation to the orifice of the hernial sac. In the oblique kind, the mouth of the sac is situated to the outer or external side of this artery; in the direct, this important part of the sac is placed to the inner side of the same vessel.

There are also varieties of the oblique kind named according to the situation of the protrusion; thus the tumour is called a "bubonocele," when the hernia has passed the internal inguinal ring, but has not protruded at the external, when, in fact, it is retained in any part of the inguinal canal. It is called "scrotal hernia or oscheocele," when it has passed through the external abdominal ring, and is therefore in the scrotum.

We propose the following anatomical classification of the varieties of oblique inguinal hernia.

1. Into the vaginal process of the peritoneum (the congenital hernia of Haller, and subsequent writers).

2. Into the funicular portion of the vaginal process of the peritoneum.

3. Scrotal, the sac being thrust into the tissues of the scrotum.

Of inguinal hernia in the male. This species escapes from the abdomen, above Poupart's ligament, through the internal and external inguinal apertures or abdominal rings. There are two varieties, the *oblique* and the *direct*.

Oblique inguinal hernia, having passed through the internal inguinal ring, lies in the inguinal canal. Pursuing the oblique direction of this canal, it emerges at the external inguinal ring, and enters the scrotum, into which it descends. The mouth of the hernial sac is situated to the outer side of the internal epigastric artery, whilst its neck and body are usually in front of the structures composing the spermatic cord. But in rare cases these organs are divided; sometimes the blood-vessels pass over the tumour, the vas deferens behind it, and *vice versa*; or they are attached to the sides of the tumour. The relative positions of the hernial tumour and testicle differ. The variable site of this organ depends upon congenital defect, and hence in some cases the testis cannot be distinguished from the tumour produced by the hernia. However, in the majority of cases the testicle is situated at the posterior and inferior region of the scrotum; more rarely, it may be detected at the front of the fundus of the tumour. An endeavour should always be made to ascertain the site of this organ, in every case of inguinal hernia, and under all circumstances.

The coverings of the sac of an oblique inguinal hernia are formed by the tissues of the region in which it lies. To expose the sac of a bubonocele, it is necessary to divide the integuments of the groin, the aponeurosis of the external abdominal oblique muscle, and the internal spermatic fascia. Some of the fibres of the free edges of the internal oblique and transversalis muscles are observable along its upper border, and some fibres of the cremaster muscle skirt its lower edge. To reach the sac of a scrotal hernia, we must divide the integuments of the scrotum, including the dartos, the fibres of the cremaster muscle, often strongly developed, and the internal spermatic fascia. This last-named fascia is the delicate membranous extension of the internal abdominal fascia along the spermatic cord.

The mode of development of the sac of an oblique inguinal hernia differs essentially in respect of the age of the individual in whom it takes place. Thus, in infancy, youth, and early manhood, the disease is usually dependent for its existence upon a congenital imperfection. To this circumstance is due the persistence of a serous canal, or sheath, in direct communication with the peritoneal cavity, through the mouth of which a portion of omentum or of bowel may enter, and thus form a hernia at any period of life. On the contrary, in adult life the hernial sac is a secondary structure, a distinctly new formation. Its development is slow; its progressive stages may be traced; and, although a prolongation of the peritoneum, its existence is due to a morbid action, which allows displacement or stretching of this serous membrane.

Hernia into the vaginal process of the peritoneum. The development of these two very different kinds of sacs has been already described (see p. 234), in considering the causes of hernia; and at the same place the reader will

find the reasons which induce the author to prefer the designations of "hernia into the vaginal process" and "into the funicular portion," to those of "congenital" and "infantile," formerly in use. There also the natural varieties found in the condition of this process will be found described.

Under abnormal conditions, the following states of this sheath are found:

1. The whole length of the canal remains open.
2. The entire canal may remain open, and an annular constriction of its walls take place between the external abdominal ring and testis.
3. The tunica vaginalis propria testis is perfected, becomes now a closed sac, but the canal continues to exist as far as the testis.
4. The abdominal orifice is completely closed, but the canal below this exists.

The diagrams are intended to illustrate the congenital conditions of the vaginal process of the peritoneum. The serous canal is represented as if cut vertically and viewed sideways.

Fig. 1. The tubular process of the peritoneum is open from the general peritoneal cavity to the fundus of the scrotum, at which part the testis is situated. This gland, however, may be fixed at different sites.

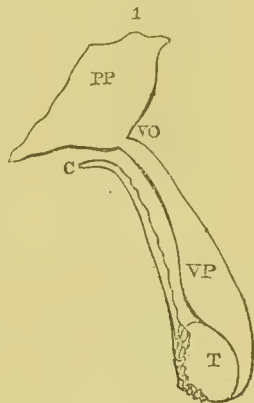
PP Parietal peritoneum.

VP Vaginal process of the peritoneum.

VO Ventral orifice of the sheath.

T The testicle.

C The spermatic cord.

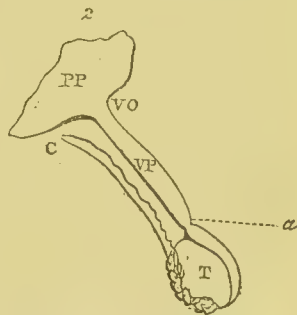


Drawings representing this imperfection may be found in the following works: Camper, *Icones Herniarum*, tab. x. fig. 3; Hunter (John), in *Medical Comm.* pt. i. chap. ix.; and in Palmer's edit. of the *Works of J. Hunter*, plates xxv. xxvi. For numerous references to books on this subject, refer to *A Treatise on Ruptures*, by W. Lawrence, F.R.S., 5th edit. 1838, p. 564.

The variety of hernia developed in consequence of this imperfection is the hernia congenita of Haller and subsequent authors.

Fig. 2. In this figure the vaginal process of the peritoneum is open, as in the last imperfection; but a contraction has taken place at the point indicated by the letter *a*.

This imperfection is demonstrated by a preparation in the Museum at Guy's Hospital, no. 2368; and a drawing from a case reported by Sir Charles Bell, in the *London Medical Gazette*, 1828, vol. i. p. 485.

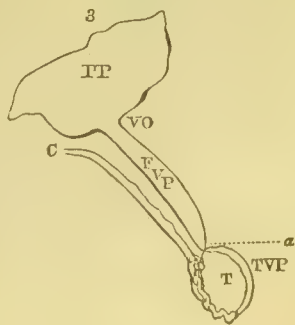


Examples of hernia into a vaginal process of this kind are noticed by Scarpa; see Wishart's translation, *Memoir*, ii. § 10. A drawing of a similar case may be seen in the work by Sir Astley Cooper on *Abdominal Hernia*, the 2d edition, by Mr. Key, pl. ii. fig. 2. Another is related by Mr. Lawrence in his work on *Ruptures*, as before, p. 574; and I have myself operated upon cases of this kind, descriptions of which are given in this essay (p. 298). A large hernial sac with this remarkable condition may be examined in the Museum of the Royal College of Surgeons of England, no. 1343.

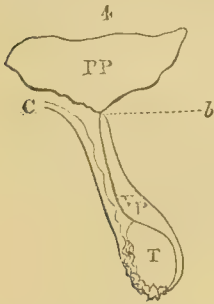
The reference-letters relate to the same parts as in the preceding diagram.

Fig. 3. This diagram shows the division of the vaginal process of the peritoneum, at *a*, into the inferior testicular vaginal process, TVP; and the superior funicular vaginal process, FVP, at the ventral end of which a communication with the abdomen remains, as in the two preceding diagrams, VO.

This imperfection is delineated by Camper. In



the work *Icones Herniarum*, folio, 1801, plate x.; he contrasts it with that one represented in fig. 1. The drawing was made from the dissection of an infant, in 1759. Seiler also gives a figure to illustrate a rather more contracted state of this part of the vaginal process, in a work entitled *Obs. de Testiculis ex abdomine in scrotum descensu*, &c. More recently, M. Malgaigne has described the frequency of hernia in association with this imperfection, *Leçons Clin. sur les Hernies*, Paris, 1841; and in *L'Union Médicale*, 1854.



Examples of hernia into the funicular portion of the vaginal process of the peritoneum occur very commonly in children, and a preparation of a hernial sac, originating with this defect, is preserved in the Museum at the Royal College of Surgeons, no. 1328.

Fig. 4. In this diagram the vaginal process, VP, is represented as a tube passing down in front of the spermatic cord and testis. The ventral orifice has been closed at *b*. The other letters refer to the same parts as in the preceding diagrams.

This is the condition of the vaginal process of the peritoneum described by Mr. Hey, in which he "found that the tunica vaginalis was continued up to the abdominal ring." *Practical Obs. in Surgery*, 3d edit. 8vo, 1814, p. 227.

I suspect that it is this imperfection of which preparations exist in museums, described as "a congenital hernial sac with the mouth obliterated," when unaccompanied with a history that the man from whom it was removed had ever been ruptured.

Associated with congenital persistence of the vaginal process of the peritoneum, the testicle of the same side as that on which the defect occurs frequently occupies an abnormal situation.

When in its normal site at the lower part of the scrotum, it cannot always be distinguished from the hernial protrusion which occupies the same serous sac as this organ and overlies it. But although this region should contain a hernial tumour, the testis may not have reached the scrotum at all.

The situations in which it is then found are as follows:

1. Within the abdomen; the vaginal process extending into the inguinal canal, but not reaching further than just through the external abdominal ring, or into the upper part of the scrotum.
2. Fixed in the inguinal canal out of the reach of manipulation; whilst the serous canal, passing into the scrotum, forms a sac for the reception of a hernia.

3. Immediately outside the external abdominal ring at the upper part of the scrotum; in which state, when a hernia descends, it passes in front of this organ into the scrotum, even as low as its fundus.

A defective development of one or even both sides of the scrotum is associated with the cases of deformity above described, which may lead the Surgeon to discover an abnormal position of the testis; a fact of great importance in the treatment of these cases of hernia.

Tabular view of the abnormal conditions of the vaginal process of the peritoneum, deviations from the normal situation of the testis, and the relative position of the hernia.

Hernia into the vaginal process of the peritoneum:

1. The vaginal process continuing open and common to the cord and testis.

The testis may be situated—

- a*, in its normal site at the fundus of the scrotum;
- b*, just outside the external abdominal ring, or between its pillars;
- c*, within the inguinal canal;
- d*, within the abdomen.

N.B. In *a*, *b*, *c*, the hernia is generally in contact with the testis; in *d* it is not.

2. The vaginal coverings of the cord and testis communicating by an aperture.

The testis in the scrotum.

N.B. The hernia may or may not pass through this aperture, and is therefore sometimes but not always in contact with the testis.

3. The vaginal covering of the cord only being open.

The testis in the scrotum.

N.B. The hernia is never in contact with the testis.

APPENDIX.—*Additional sacs, or prolongations and extensions of the vaginal process within the abdominal walls.*

Concurrent with these instances of mal-placed testis are some of those complicated cases of hernia which arise from varieties in the configuration and anatomical disposition of the hernial sac. In a majority of the cases in which the hernial sac follows any very unusual direction, the hernia is found to occupy the same sheath as the testis, or a portion of that sheath—a sufficient proof of the precise nature of the hernia and of the cause of its development, if any be required. Several cases are recorded in which a sort of second sac or offset from the vaginal process of the peritoneum extended between the structures composing the abdominal walls. Hence the terms “intraparietal,” “ascending, or intermuscular,” and “interstitial,” have been applied to this variety of hernial sac. Belonging also to this category are the cases termed “hernie en bissac” by French writers. These cases form two classes :

1st. Those in which the sac extends into the anterior abdominal walls.

2d. Those in which it extends into the inferior walls.

In the first class, the sac extends upwards from the inguinal canal in front of the internal abdominal fascia, and behind the aponeurosis of the external abdominal oblique muscle. It may take a course directly upwards ; outwards, towards the crest of the ilium ; or inwards, towards the rectus muscle and umbilicus.

If the sac has passed through the external abdominal ring and cannot enter the scrotum, it may ascend in *front* of the aponeurosis of the external abdominal oblique muscle, lying between it and the integuments ; and when the hernia protrudes, it forms a tumour in the groin above and parallel with Poupart's ligament. An example of this rare variety is quoted by Scarpa,* and another case has been recorded by Dr. Fano.†

In the second class, the sac extends into the iliac fossa and rests upon the iliacus muscle, between the internal abdominal fascia and peritoneum ; or directing itself inwards, it passes behind the horizontal ramus of the pubes, and reaches the side and front of the urinary bladder.‡

Hernia into the funicular portion of the vaginal process of the peritoneum. When the Surgeons of the last century discovered that a hernia could pass into the vaginal process of the peritoneum, and there be in contact with the testicle, they appear to have been content with this fact, and, without further research, to have assumed this variety to be the only form of hernia dependent for its origin upon non-closure of the abdominal orifice of this canal, or defective obliteration of the upper part of the vaginal process of the peritoneum. Thus many writers acknowledge the fact that an infant may be the subject of a scrotal hernia, and, after detailing such a case, they add, “but not congenital ;” implying by that expression simply the anatomical fact that the hernia is in a distinct sac, and thereby separated from the testis, in the same manner as it occurs in the adult. The term suggested in this essay precludes an erroneous view of those varieties of hernia which originate in

* *Treatise on Hernia*, translated by Wishart, 1814, 8vo, p. 171.

† *L'Union Médicale*, Dec. 1861.

‡ Cases by Dr. Parise, in *Mém. de la Soc. de Chir. de Paris*, 1851 ; *Mém. sur deux variétés nouvelles de Hernies*.

congenital defect of the coverings of the testis and spermatic cord, and renders the disease in the infant and in youth much more easy of comprehension.

The reader should recall to mind the previous statements relating to the descent of the testicle, and the development of the tunica vaginalis propria testis out of the inferior termination of the vaginal process of the peritoneum. For surely there cannot be a tunica vaginalis propria testis developed so long as a canal exists along which a hernia may descend and touch the testis. Herein consists the deficiency; in this anatomical fact lies the defect. But when the testis is enveloped by the two layers of the serous membrane, the visceral and parietal, whereby the cavity of the tunica vaginalis testis is formed, in its own proper vaginal sheath, and is entirely shut off from every protruding viscus, there may remain the upper portion of the vaginal process of the peritoneum communicating with the abdomen at the internal abdominal ring. Into this canal, termed the tunica vaginalis propria funiculi, or the funicular portion of the vaginal process of the peritoneum, a hernia may protrude, and it thus becomes converted into a hernial sac; quite as much "congenital," too, as the variety ordinarily characterised by that term, for it is dependent upon a congenital defect, viz. the non-closure of the abdominal orifice of the canal, and its continuation in front of the spermatic cord as far as the testis and its vaginal sheath. This variety is now distinguished as hernia into the funicular portion of the vaginal process of the peritoneum.

In the new-born infant, or at a later period, some weeks or months after birth, it is not at all uncommon to see males with a hernial protrusion occupying the inguinal canal and scrotum, but entirely separated from the testis, which is normally situated, at the fundus of the scrotum.

M. Malgaigne was, I believe, the first Surgeon to notice this variety of hernia, and to point out its origin, anatomical relations, and distinctive features. It is exceedingly common. Carefully instituted examinations lead us to conclude that it is nearly as frequently met with as the ordinary variety last described; but, from the fact of its having been confused with the scrotal hernia of the adult, very little attention has been bestowed upon it. The diminutive size of the testis has also led to its relative situation, as regards the hernia, being wholly overlooked and neglected; for cases which we have ourselves examined have generally been regarded as of the ordinary kind, termed "congenital," and not worthy of further consideration. In the earlier periods of life, the distinction is not, perhaps, of primary importance; but the recognition of this variety in youth and adult life becomes a necessity of great moment in some instances, not only in reference to correct diagnosis, but also with respect to the judicious treatment of the case.

In these cases the hernia being enveloped by a peritoneal sac, the pathologist must admit one of two explanations of its development: either that the parietal peritoneum of the abdomen was suddenly pushed downwards before the hernia to form its sac; or that a serous canal existed continuous with the peritoneal cavity, which became converted into the hernial sac. The last explanation, being strictly in accordance with anatomical facts, appears to me to be the one which the morbid anatomist will adopt.

The congenital patulence of the funicular portion only of the vaginal process of the peritoneum is capable of proof by anatomical examination, and there is no more reason to question its remaining so during the later periods of life, than to dispute the fact of the occasional unobliterated state of the entire length of the vaginal process to the fundus of the scrotum in adult life. We are able to adduce abundant facts to prove the development of hernia in such cases, if space permitted.

In advancing adult life the orifice of the hernial sac still maintains its original relations to the internal abdominal ring, and especially its depth. Under these circumstances, a hernia having existed many years, the abdominal rings are not approximated, but remain widely separated. A man, 45 years old, was operated upon by myself on account of strangulated oblique inguino-scrotal hernia, with which he had been afflicted since boyhood. This

was the first time he had found any difficulty in returning the protrusion. The orifice and neck of the sac were deeply seated; that is, the index-finger was passed along the inguinal canal to reach the abdominal orifice of the sac. It did not require division, but was sufficiently large to allow of the reduction of the hernia after the sac had been opened and a large quantity of serum had escaped. His case terminated successfully. The testis was at the fundus of the scrotum, and separated from the contents of the hernial sac.

The next question relates to the frequency of these varieties of hernia into the vaginal process of the peritoneum.

After making inquiry of patients afflicted with inguinal-scrotal hernia for many years, we were much surprised to find that so many of them stated that the protrusion occurred suddenly, and was first observed when the dimensions of the scrotum were increased by the presence of the hernia. Another circumstance also attracted attention. Robust, healthy, and well-developed men, of middle age, asserted that the rupture first descended when they were about 20 years old—a circumstance nowhere specially alluded to; but it appears to be a very common occurrence. When discussing this matter with friends and stating this fact, they have suggested that working-men might not be very accurate in their statements, and that, being habitually thoughtless of their persons, no dependence could be placed upon their assertions. This objection has had its due consideration and weight in our inquiries, and we have, therefore, only referred to recent cases, or accepted the accounts afforded by those patients who seem to possess a fair average intelligence, and might be presumed to give reliable information concerning the subject of inquiry. During the two years 1859 and 1860, forty-four patients, suffering more or less from inguinal hernia, were admitted into the wards of Guy's Hospital. Among them were twenty-six cases of hernia into the vaginal process of the peritoneum; and of these, twelve had the testis and hernia in contact (the hernia congenita of Haller), whilst in the remaining fourteen the hernia occupied the funicular portion of the canal, and was separate from the testis. In several patients the hernia was developed suddenly, and reached the scrotum at once, the first time it was observed; even in adult life, the men being robust and well developed. The respective ages of the patients, at the time they came under examination, varied between fourteen months and forty-seven years.

Pott wrote, nearly a hundred years since: "Ruptures attended with that particular circumstance which brings them under the description mentioned in the title, are said to be very rare; but, from what I have observed, both in the living and in the dead, I am inclined to believe that they happen much oftener to adults than they are suspected to do."*

To demonstrate, perhaps even more satisfactorily, that a large proportion of the cases of inguinal hernia is developed at a very early period of life, we may refer to the Reports of the City-of-London Truss-Society, so industriously drawn up by Mr. Kingdon.

The total number of males applying at the Society during the years 1860 and 1861, whose ages were ascertained at the time the hernia was first observed, amounted to 7543; of these, 3963, or 383 more than half, had reached only thirty years of age. Thus it appears certain that inguinal hernia is developed very frequently before thirty years of age.

This statement, which may be accepted as correct, is fully supported by reference to the table I have arranged from the Report of the City-of-London Truss-Society (see Table, p. 228). By this it appears that inguinal hernia occurs very frequently during the first twelve months after birth. This happens in consequence of the congenital persistence of the canal of the vaginal process of the peritoneum. Its frequency then diminishes to puberty,

* *An Account of a particular kind of Rupture, &c., viz. that in which the Intestine or Omentum is found in the same cavity and in contact with the Testicle*, by P. Pott, Lond. 1765, 2d edit. p. 5.

after which period the cases rapidly increase to the completion of thirty years of age.

Taking periods of ten years, or decades, the frequency of inguinal hernia at different ages is well seen (see Table, p. 228). It is remarkable that the first decade contains the largest number of cases, and next the third, or that between twenty and thirty years of age. From this period of life the cases decrease in a rapid ratio.

Hour-glass-shaped contraction of the sac of oblique inguinal hernia. An uncommon peculiarity in the conformation of the sac itself of an oblique inguinal hernia occurs in consequence of a narrowing of its walls at a point corresponding with the site of the external abdominal ring, or a little below that point in the scrotum between the testis and that aperture. When a hernia fills the sac, it may become strangulated by this constriction. The outline of the hernial tumour, as well as that of the sac, exactly resembles the shape of the ordinary hour-glass; hence the name given to it. It is always associated with a congenitally open state of the vaginal process of the peritoneum. The result of the imperfect closure of this sheath, at that part where union of its walls normally takes place, is to give rise to the formation of a ring or circular constriction within this process of the peritoneum at the point where the tunica vaginalis propria testis and tunica vaginalis propria funiculi blend together. Instead of the upper division of this canal being closed, and the two divisions, by this means, rendered distinct from each other, they communicate freely. The result is, that a hernia passes through the abdominal orifice of the funicular portion of the canal, traverses it, and then passes through the contraction into the cavity of the tunica vaginalis propria testis, which gland it touches. Instances of this constricted condition of the sac of an oblique inguinal hernia are related by Pott,* Wrisberg, Le Cat, Scarpa,† Pelletan, Sir A. Cooper, and Mr. Lawrence.

Case. A labourer, 29 years old, was brought into Guy's Hospital, in September 1858, in a state of great prostration, and having a rupture in the left side of the scrotum. There had never been any tumour noticed until seventy-eight hours before admission. All observers were struck with the small size of the neck of the tumour, its pear-shaped form, thus closely resembling the outline of a hydrocele, and the seeming absence of the left testis. The external abdominal ring was distinctly recognisable, and I could pass my fingers through it, but I could not make out distinctly the spermatic cord. On palpation a very audible gurgling sound was produced in that division of the swelling between the internal ring and the upper part of the scrotum, the integuments of which were red, tense, and shining. The whole tumour was divisible into a superior division and an inferior. This last, which was the largest, remained unaltered by manipulation, was firm, and resisted pressure, although slightly elastic, and was very painful when compressed. The upper division was soft, and the swelling entirely disappeared when slight pressure was applied; but it was reproduced by the contraction of the abdominal muscles, or by pressure on the abdomen above the internal ring. All the symptoms of strangulated intestine being strongly marked, and considering that the liberation of the hernia was imperative, I administered chloroform; and finding, when the man was fully under its influence, that I was still unable to reduce the protrusion, I determined to operate at once. An incision of the integuments, four inches long, was made, the direction of which was parallel with the long axis of the tumour, and the centre corresponded with the site of the external abdominal ring. This aperture, although seen, was not sharply defined. I could now pass my finger upwards on the outside of the hernial sac to the internal ring, and trace its boundary. A very distinct constriction was now seen in the body of the tumour, producing the form of an ordinary hour-glass. This contraction corresponded with the ramus of the pubes over

* *Chir. Works*, edit. 8vo, 1808, vol. ii. pp. 118, 184, case xiv.

† *A Treatise on Hernia*; translated by Wishart, 8vo, 1814, p. 138, pl. v. fig. 2.

which it crossed. I opened the superior division of the hernial sac above this constriction, and exposed healthy intestine only. I next endeavoured to extricate the bowel from the inferior division of the sac; but I was unable to release it. A grooved director was carefully introduced into the inferior sac, and much blood-tinged serum escaped along the groove. Still, even when all the serum had run out, and traction was made on the bowel from above, it was inextricable! What chance, then, was there of reducing the bowel by the taxis? The constriction of the sac having been divided, the strangulated bowel was easily returned into the abdominal cavity without any enlargement of its abdominal orifice being required. The left testis was visible at the fundus of the sac—sufficient evidence that the hernia had descended into the vaginal process of the peritoneum. This man recovered.

Other cases of this kind have occurred in my practice. They are not, I suspect, quite so uncommon as at first sight we might be led to assume. Out of forty cases of oblique inguinal hernia, which Mr. Kingdon selected for me, in order to illustrate quite a different subject, I find that he observed the characteristic hour-glass contraction of the scrotal tumour in four men in whom the hernia was developed at the respective ages of 17, 29, and 30 years, and one in boyhood.

But what explanation can be given of the constriction of the bowel by the sac at such an unusual part? Let us seek for it by an examination of preparations and a reference to the physiological changes taking place in the vaginal process of the peritoneum before, or soon after, birth. Before doing this, let us distinctly isolate and exclude from the class of cases about which we are writing all those in which the impediment to the reduction of the hernia, or the cause of constriction of the bowel, depends upon the development of adventitious bands crossing the cavity of the sac without any definite or specific arrangement. Hernial sacs, showing such peculiarities as last mentioned, are preserved in the London museums; but they are quite foreign to our immediate purpose, and belong to a perfectly distinct category as regards their development and relations to the sac and its contents.

In the cases we are now describing the hernial protrusion and testis are in contact, otherwise the case would not belong to this class.

In the Museum at the Royal College of Surgeons there is a Hunterian preparation, no. 1343, thus described in the catalogue: "The sac of a large congenital hernia. The exterior of the sac is uneven and sacculated, through the unequal yielding of different parts of its walls: the testicle is situated at the lowest part." This account is not sufficiently descriptive or explicit of the structure of the hernial sac and its relations to the testis. A careful examination of the interior of the sac shows a large superior division and a small inferior. In the last the testis may be recognised; but between the divisions an imperfect septum, or perforated diaphragm, existed before the vertical section of the entire sac was made, and by means of this foramen a communication was established between them. The sharp, well-defined, free edges of this septum are seen stretching from the sac-wall to the testis, as well as its strong attachment to the sac itself. Now, assume the cut edges of this sac to be joined together, and the superior and inferior sacculi would be complete, although any foreign body might be passed from the one into the other. A hernia, for example, filling the upper sacculus, might pass from it through the aperture in the diaphragm into the lower, and then become constricted by the margins of this annular contraction.

But a preparation in the Museum at Guy's Hospital, no. 2368, at once affords a satisfactory clue to the solution of these somewhat remarkable cases. It is the vaginal process of the peritoneum taken from a child. It shows a portion of the parietal peritoneum of the abdomen with the whole process extending downwards from it. This process has been opened along the whole extent of its anterior surface. At the superior extremity the canal communicated with the abdomen, and at the inferior extremity the testis may be seen; and between these two points, about midway, the cavity is contracted. When this tube was uncut, there must have been an opening or narrow passage

near its centre, through which a protrusion, coming by the abdominal orifice, and traversing the funicular portion of the vaginal process, must have passed to reach the testis. A constriction resembling this formed the impediment to the reduction of the hernia in the cases above described.

Sir Charles Bell describes a hernial sac of this kind which came under his observation in connexion with an obscure case of hernia, which he has recorded in the *London Medical Gazette* of 1828.* "There was another remarkable circumstance observed, which related to the sac lodged in the scrotum. At the lowest part there was a hole of communication between that sac and the cavity which is between the coats of the testicle. This orifice was so large that the finger could be passed through it; and its margins were so dense as to resist dilatation." In the explanation of the woodcut, he writes: "A bougie has been passed from the hernial sac into the cavity formed by the tunics of the testicle, through an opening which forms a communication between them."

A careful examination of the second figure of the 2d plate of Key's edition of Sir Astley Cooper's work on Hernia will satisfy any one that it delineates a case of the kind we are describing. It was a "congenital hernia firmly constricted by an annular contraction of the sac itself," although described as "a band of membrane adhering to the sides of the tunica vaginalis, *through an aperture in which* the intestine has protruded and become strangulated." The hernia is seen both above and below this aperture; the portion below "discoloured by the effects of strangulation" produced by its margins; the portion above, "below the internal ring and above the strangulating band, free from pressure and retaining its natural appearance." Now in this description we have but a repetition of the appearances I observed in the case under my own treatment, related at p. 298. In chap. xvii. on *Congenital Hernia*, Sir Astley Cooper states that in this variety "the stricture is much oftener found to be *within the sac*, than in the ordinary kinds of hernia;" and he relates a case, upon the authority of Mr. Hodgson, of Lewes, in which the intestine "was found strangulated within an aperture of the tunica vaginalis. The intestine appeared to have suffered more from this stricture than from the ring."

Lastly, Mr. Lawrence,† when describing cases of this kind, records one in which, "about half-way between the testis and groin, the hernial sac was so contracted that a probe only would pass into the stricture." In this case, too, the abdominal orifice of the sac "would not admit the smallest portion of the tip of the finger," and it also formed an impediment to the reduction of the hernia; in this respect differing from my case.

By these quotations, to which numerous instances might be added, especially those recorded by Mr. Pott, with dissections, case 14,‡ it is capable of demonstration that this class of cases must be confined to those forms of inguinal hernia dependent upon congenital defect or persistence of the vaginal process of the peritoneum throughout life.

But a glance at a plate in Camper's work§ will more easily explain the nature of these cases. Figure 2 shows the cavity of the right vaginal process of the peritoneum opened vertically from the abdomen to its inferior termination; at which point is seen the testis. Figure 3 shows the left side, in which, just above the testis, the entire canal is divided into two portions by the internal surfaces of the serous membrane united together. Should it, however, happen that this septum is not complete, a mere contraction takes place, and a ring is thus formed, keeping up a communication between the persistent funicular portion of the vaginal process, which is above, and the cavity of the imperfect tunica vaginalis testis below. By the constant pressure around a hernia, the tissues composing this annular contraction of the hernial sac become more and more dense, until it forms a firm, fibrous, callous ring at the situation where the tunica vaginalis ordinarily terminates just

* Vol. i. p. 484; also a woodcut.

† *On Ruptures*, 5th edit. p. 574.

‡ His *Chirurgical Works*, edit. 1808, vol. ii. p. 184.

§ *Icones Herniarum*, tab. x. 1801.

above the testis ; its variable distance from that gland depending, in different cases, upon the larger or smaller size of the protrusion, and the consequent distension of the tunica vaginalis testis.

The differential diagnosis between these cases, of hernia into the vaginal process of the peritoneum, and the ordinary form of inguino-scrotal hernia is formed by the manner of their development, the age at which they first appear, and their configuration. Whilst the common form is developed slowly, these appear suddenly, and often pass at once into the scrotum without resting in the inguinal canal. They are noticed in the earliest infancy, throughout childhood, and during early adult life. Their form or outline is highly characteristic. The tumour projects in a remarkable manner from the external outlet of the inguinal canal ; directly the rupture escapes from the embrace of the external abdominal ring, the form is more globular and rounded in comparison with the pyriform outline of the hernia of slow formation in adult life. The testis can or cannot be felt ; when it is easily detected, it is evident that the gland and rupture are in separate sacs, and *vice versâ*.

In the hour-glass-shaped variety the configuration alone is sufficient to attract notice and lead to its diagnostication.

When the hernia is reducible, the depth of the internal abdominal ring and the length of the inguinal canal are discoverable by tactile examination.

The importance of recognising these cases. It is highly important to recognise the cases of hernia into the vaginal process of the peritoneum, in a practical point of view, especially in relation to their treatment. Much more severe constitutional symptoms usually accompany strangulation in these cases, and this condition of the hernia takes place more rapidly than when the hernial sac has been of slow formation. They require, therefore, the liberation of the bowel as soon as it is possible.

Considerable difficulty is experienced in reducing these protrusions by the taxis, in consequence of the depth of the orifice of the sac, the inability of the operator to fix it or command its movements, the contraction of its orifice, its unyielding textures, and the length of the neck of the sac, or that part of it lying between the two inguinal rings within the inguinal canal. In cases of the hour-glass contraction of the sac, the taxis is generally useless if the bowel has been strangulated but a few hours, and persistence in such attempts is extremely hazardous. Under any conditions, the Surgeon must remember that two distinct and separate contractions exist, through which the rupture must have passed ; one of these being situated in the body of the sac, the other being its true ventral orifice. Either of these contractions, or both of them, may offer insuperable impediments to the reduction of the hernia, unless their tissues be cut.

If we scrutinise any large number of cases of inguinal hernia admitted into the hospitals, a majority of those requiring the liberation of the bowel by a cutting operation are patients under 30 years of age. At St. George's Hospital, out of 28 males suffering with strangulated oblique hernia, 17 were under 30 years of age ; 11 had passed that age.* At Guy's Hospital, of 57 cutting operations performed in order to liberate a strangulated inguinal hernia, 33 belonged to the class of which we are writing, 24 were of the old slowly-forming variety. Next, in order to demonstrate with how much greater facility the old inguino-scrotal hernia is reduced by the taxis, than that descending into the vaginal process of the peritoneum, we may refer to 129 cases of oblique inguinal hernia, admitted also into Guy's Hospital. Of these, 59 had traversed the canal of the vaginal process of the peritoneum, 70 belonged to the old inguino-scrotal variety. Or, tabulated thus :

Of inguino-scrotal, the sac of which formed slowly	} 94 cases	{	requiring a cutting	
			operation . . .	24 or 25·53 per cent
			reduced by taxis . 70 „	74·46 „

* *Medical Times and Gazette*, 1861, vol. i. p. 624.

Of ing-scrotal descend- ing along the vaginal process of peritoneum	92 cases	{ requiring a cutting operation . . . 33 or 35·86 per cent reduced by taxis . 59 „ 63·04 „
---	----------	--

Another subject of great importance relates to the application of the taxis. In some of those cases in which the hernia, when strangulated by the orifice of the sac, was supposed to have been returned into the abdomen in a mass, more careful examination after death showed that the inguinal portion of the sac was burst, and that the bowel had been pushed through the laceration, and was lying outside the peritoneum, between it and the internal abdominal fascia. This accident is more fully described at page 271. In these cases also, the mouth of the sac is sometimes detached from its connexions. When the patient is youthful, and the anæsthetic effects of chloroform are fully produced, great caution is, therefore, necessary in using the taxis, on account of the slight and delicate connexions of the peritoneum to the neighbouring parts at this early age.

Difficulties also attend the operations on these cases, in consequence of the depth of the orifice of the sac, the variable position of the testis, and the varieties which may be encountered in the disposition of the hernial sac, all of which have been before described.

Infantile hernia. The infantile hernia of Hey, and the encysted hernia of the tunica vaginalis of Astley Cooper, are synonymous terms for a variety of the oblique inguinal hernia, depending likewise upon an abnormal condition of the tunica vaginalis peritonei. The state of that sheath which precedes the development of this kind of hernia depends upon the ventral orifice being closed, but the canal persisting from that point to the testis. The hernia slowly pushes before it the parietal peritoneum of the abdomen into this sheath, and when the parts are dissected, it is seen that "the tunica vaginalis is continued up to the abdominal ring, and encloses the hernial sac," as Mr. Hey describes. In this manner "the protruded parts, together with the sac, are contained in the tunica vaginalis testis" (Lawrence, *A Treatise on Ruptures*, p. 576).

The name given by Hey to this variety of hernia leads the reader to infer that it is always developed in infancy. This, however, is not the fact. Hey's case was an infant 15 months old. Forster's case, related by Cooper, was 31 years old at the time of the operation. The duration of the rupture is not specially stated, but the description induces us to believe that it had not existed long. In Lucas's case the rupture was developed at about 17 years of age. The man in Forster's second case had been ruptured all his life. Mr. Holmes reports a case in which the rupture was developed about 12 years of age; and I operated upon a man in Guy's Hospital, 42 years old, who was not ruptured until he had completed his 35th year.

Cases of this kind are very rare. Their precise nature is usually only detected during the time of the operation, when the Surgeon finds that on cutting into the tumour, a serous cavity is opened, which contains the hernial sac, invested externally by a serous membrane. Within this, the true hernial sac, the rupture is found. The operator may also be a little puzzled by finding the tumour so remarkably movable, after he has incised the first serous sac. The whole tumour, with the testis attached to its walls, falls out, and seems to be only suspended by its attachment to the margins of the external abdominal ring.

Inguino-scrotal hernia of slow formation. That variety of oblique inguino-scrotal hernia which occurs in middle and late adult life, and forms for itself its own sac by pushing the parietal peritoneum before it, causes at first a slight swelling at the internal abdominal ring, slowly traverses the inguinal canal, and at last occupies more or less of the scrotum. To the "pointing" of the hernia at the internal inguinal ring, as M. Malgaigne aptly terms it, the attention of the Surgeon is sometimes drawn. Upon inspection a slight elevation of the integuments over the internal inguinal ring is observable, which becomes more prominent when the patient contracts the abdominal muscles

or coughs, especially if standing erect. In this posture, and under similar influences, if the finger be placed over the ring, the hernia is projected against it, and the sensation thus induced is termed the impulse of the rupture.

At this period a truss should be constantly worn. If made to fit comfortably, it may prevent the further escape of the viscera; and by counteracting their disposition to propel the parietal peritoneum outside the abdomen, the development of the hernial sac is avoided.

As the hernia becomes further removed from the internal inguinal ring, it forms a swelling in the inguinal canal. The long axis of the tumour is parallel with Poupart's ligament, and therefore follows the oblique direction of that firm, fibrous structure from above, downwards and inwards. This bubonocoele, as the tumour is usually called, is covered by the integuments of the groin and the aponeurosis of the external abdominal oblique muscle. Along its superior border it is overlapped by the free edge of the internal oblique and transversalis muscles; along its inferior by the cremaster muscle. It lies upon the internal abdominal fascia as it emerges at the internal inguinal ring, afterwards upon the conjoined tendons of the internal oblique and transversalis muscles, just before it reaches the external inguinal ring. Under these dispositions of the fleshy and tendinous fibres of the abdominal muscles, the hernial sac with its contents is in a very especial manner under the influence of their contractions; more especially in the region of its mouth and neck: hence a frequent impediment to the reduction of a hernia. The spermatic cord usually lies behind the tumour at the internal inguinal ring, and is attached to the posterior surface of the sac as it traverses the inguinal canal.

As the development of the sac advances, it is pushed through the external inguinal ring, over the os pubis, and into the scrotum. As the hernia points at the external inguinal ring, it forms a somewhat globular swelling; but as its bulk increases, in its progress towards the fundus of the scrotum, the shape of the tumour is generally pyriform, when the scrotum is distended with the hernia. In the body of the tumour contractions or depressions, generally following an oblique or transverse direction, are occasionally observable.

The testis is usually below the tumour, sometimes behind it. The elementary structures of the spermatic cord may generally be traced along its posterior or outer boundary, sometimes close together, but rarely separated from each other.

When the hernia is reduced, the forefinger may be passed with facility into the abdominal cavity through the external inguinal ring, the inguinal canal, and the internal inguinal ring. This is practicable on account of the approximation of those rings taking place from the pressure of the hernia and the relaxation of the surrounding structures. The mouth of the sac and the inguinal apertures are indeed sometimes so large that the finger may be freely passed to the abdominal surface of the symphysis pubis; and the pulsation of the epigastric artery, or of the external iliac, may be felt in the usual situations of those vessels.

A tabular arrangement of the characteristics of the three varieties of oblique inguinal hernia in males.

A. Into the VAGINAL PROCESS of the PERITONEUM. (<i>Hernia congenita Halleri.</i>)	B. Into the FUNICULAR PORTION of the vaginal process of the peritoneum.	C. INGUINO-SCROTAL; into the tissues of the scrotum.
1. Is developed most commonly in infancy; occasionally in youth; rarely in adult life. 2. Is suddenly produced. 3. At once descends along the inguinal canal into the scrotum. 4. May rest in the inguinal canal when the testis is <i>not</i> in the scrotum. 5. Envelops the testis, and lies in contact with that organ. 6. The orifice of the hernial sac is contracted, and corresponds with the site of the internal abdominal ring. 7. Neck of the sac long and tubular; it lies in the inguinal canal, between the rings, which are <i>not</i> approximated, even in the adult. 8. Hernial sac a direct, congenital prolongation of the peritoneum; tubular when not distended with a hernia. It reaches the testis in the scrotum, and envelops it. Thus there is a congenital serous canal to receive the hernia.	1. Is developed frequently in infancy; often in youth and in adult life. 2. The same. 3. The same. 4. May rest in the inguinal canal when the testis is in the scrotum. 5. The testis, at the fundus of the scrotum, occupies its own serous sac, which separates it from the hernia. It usually produces a very distinct prominence at this part. 6. The same. 7. The same. 8. Hernial sac, a direct congenital prolongation of the peritoneum; tubular when not distended with a hernia. It does not extend into the scrotum so low as the testis. A congenital serous canal exists to receive the hernia.	1. Occurs in adults, I believe, exclusively. 2. Is slowly produced. 3. By slow degrees traverses the inguinal canal and scrotum. 4. May remain in the inguinal canal for an indefinite period, the testis being in the scrotum. 5. Is separate from the testis, which is at the fundus of the scrotum. 6. Orifice of the sac large and near the external abdominal ring. 7. Neck of sac short, dilated; inguinal canal shortened; the rings <i>being</i> approximated. 8. Hernial sac a new formation, and slowly developed by the pressure of the abdominal viscera against the parietal abdominal peritoneum, which by extension before the hernia is thus formed into a sac for it. Here the hernia forms its own sac by pushing the peritoneum before it. The tubular character of the sac is wanting.

Diagnostication. Every inguinal hernia escapes from the abdominal cavity above Poupart's ligament. If, therefore, the tumour formed by an inguinal protrusion be examined whilst in the inguinal canal, Poupart's ligament is traceable along its inferior border, and the opening where the tumour seems to make its escape from the abdomen is above the same fibrous band. It may be always

distinguished, then, from crural hernia; for that kind generally escapes through the crural ring, which is situated behind and below Poupart's ligament, and that ligament may be always traced along the superior border of the tumour.

Again, an inguinal hernia reaches the scrotum through the external inguinal ring, the outer pillar of which is formed by the pubic attachment of Poupart's ligament to the spinous process of the pubes. Now place the tip of the finger upon the last-mentioned process of bone, and if the neck of the tumour lies to its inner side, or between the finger and the symphysis pubes, the tumour must be formed by a protrusion which has passed through the external inguinal ring; a fact sufficiently demonstrative of an inguinal hernia. Should the tumour be to the outer side of the finger, the probability is that the hernia has passed through the crural ring.

Differential diagnosis. The Surgeon is often required to distinguish between inguino-scrotal hernia and some other tumours developed in the inguinal region and scrotum.

These are—1st, the different kinds of hydrocele; 2d, the encysted spermatocele connected with the epididymis; 3d, varicocele of the spermatic veins; 4th, inflammation of an old hernial sac, and the results of such inflammation; 5th, inflammatory affections and other diseases of the testis, the cord, and their coverings; 6th, hæmatocele; 7th, malpositions of the testis; 8th, inflammatory and other diseases of the inguinal lymphatic glands; 9th, growths of fat in the connective tissue of the inguinal canal and upon the spermatic cord; 10th, diseases of the integuments of the scrotum, especially growths, as elephantiasis.

The nature of these diseases being described in other parts of this work, the observations we have to make in relation to the differential diagnosis between them and inguino-scrotal ruptures may be condensed into a tabular form. This plan was suggested by the perusal of a chapter written by M. Vidal (de Cassis), entitled "Chronic tumours of the scrotum considered in a diagnostic point of view."*

To one variety of hydrocele it is perhaps necessary to make a special allusion. In rare instances serum collects in the vaginal process of the peritoneum, when its ventral orifice is patent, and the accumulated fluid may be pressed out of the scrotum into the peritoneal cavity through that aperture. This condition usually occurs in infants, but we have seen it in adults, complicated even with a hernia. The differential diagnosis is stated in the table.

The chronic tumours of the scrotum may be arranged in two divisions:

I. The reducible.

II. The irreducible.

In the first division there are:

1. Inguinal hernia,
2. Hydrocele of the vaginal process of the peritoneum.
3. Hydrocele of the funicular portion of the same process.
4. Varicocele of the spermatic veins.

* *Traité de Path. externe*, edit. 1841, vol. v. p. 715.

I. The reducible tumours.

	Their entrance or return into the abdomen.		Their passage from the abdomen.
	Characters in common.	Special characters: when without complications.	Special characters.
1. INGUINAL HERNIA.	All return into the abdomen most easily when the patient lies down on the back and when the abdominal muscles are relaxed.	1. <i>Hernia</i> enters most readily. When once commenced, passes in quickly and suddenly. Entrance complete. Opaque and thick neck of tumour. Testis may or may not be perceptible until reduced. <i>No vibration.</i>	1. Is developed from above, descends when the patient rises or exerts the abdominal muscles, and more quickly than others. The finger pressed over the ring prevents its descent.
2. HYDROCELE OF VAGINAL PROCESS OF PERITONEUM.	—	2. <i>Hydrocele</i> of vaginal process of peritoneum enters slowly, and never suddenly. Entrance complete. Translucent and small neck of tumour. Testis imperceptible until the fluid has entered the abdomen. <i>Vibration.</i>	2. Seems to be developed from below upwards. The serum sometimes remains in spite of the horizontal position.
3. HYDROCELE OF FUNICULAR DIVISION OF VAGINAL PROCESS OF PERITONEUM.	—	3. <i>Hydrocele</i> of funicular division of vaginal process of peritoneum enters like No. 2. Entrance complete. Translucent. Neck of tumour may pass into inguinal canal. Testis perceptible at fundus of tumour. <i>Vibration.</i>	3. Similar to No. 2.
4. VARICOCELE.	—	4. <i>Varicocele.</i> Enters very slowly. Entrance not complete, the bulk of tumour only diminished. <i>No vibration.</i>	4. The tumour increases like hernia when the patient rises; but it increases also if pressure be made over the course of the spermatic veins in the inguinal canal, or if the blood be retarded in its passage along them in any way.

II. The irreducible tumours. The tumours in the second division are composed very often of fluid only, sometimes almost exclusively of solids, but occasionally of both solids and fluids in variable proportions.

Those composed of fluid are—1. hydrocele of the tunica vaginalis propria testis; 2. hæmatocele in the same sac when first developed; 3. encysted spermatocele connected with the epididymis; 4. hydrocele of the spermatic cord.

Those formed by solids, or of solids and fluids, are—1. the diseases of the testis, *a.* of inflammatory origin, *b.* specific new growths; 2. hæmatocele of some standing in which changes have taken place; 3. diseases of the spermatic cord; 4. growths of fat extending from the inguinal canal into the scrotum; 5. diseases of the tissues of the scrotum.

Characteristics of the Irreducible Tumours compared with Hernia.

Disease.	Weight.	Translucency.	Fluctuation and vibration.	Relation of testis to tumour.	Figure and development.	Size.	Consistence.	Pain.
HERNIA.	Lighter than either the fluid or solid tumours.	Very rarely so; generally opaque.	Only when fluid coexists with the hernia.	Position variable, but the testis usually discoverable.	Pyriform, but with thick neck. Occasionally globular or ovoid. Outline regular. Begins at neck of scrotum and descends.	Variable; at times very large.	Soft and yielding, except it be omental.	Painless unless dis-eased.
FLUID TUMOURS.	Hæmatocele rather heavier than hydrocele.	Hydrocele particularly so. In rare cases opaque. Hæmatocele opaque.	Distinct; vibration very characteristic, as in hydrocele.	Perceptible in spermatocele; not in hydrocele of tunica vaginalis propria testis, usually.	Pyriform, but with very thin neck. Outline very regular. Globular as hydrocele of spermatic cord. Oblong as in spermatocele, and nearly transverse to vertical axis of scrotum. Begin near fundus of scrotum and ascend.	Rarely very large.	Yielding and elastic. Exceedingly incompressible as hydrocele of cord.	Painless, unless testis be squeezed, usually.
SOLID TUMOURS.	Generally heavier than fluid.	Opaque.	Absent.	Often involved and imperceptible though its site may be discoverable by pressure.	Outline of testis often preserved. Sometimes surface irregular.	Large; steadily increasing.	Resisting, firm and rarely hard.	Painful, but variable in degree.
MIXED TUMOURS.	Heavy.	Sometimes in parts of them.	In some parts, not in others.	Involved.	Irregular outline.	Large; at times rapidly increasing.	Resisting in parts, soft in others.	Variable.

Between the local signs of an inflamed scrotal hernial sac, especially if its orifice be plugged by omentum, and an inflamed hernia, there is a close resemblance. But from the history of the case, and the absence of those constitutional symptoms which accompany an inflamed hernia, a correct diagnosis may be formed.

The inflammatory conditions of the testis, the cord, its coverings, and the tissues of the scrotum, do not resemble hernial tumours either in their local or constitutional manifestations. It is more probable that a hernial protrusion might be considered to be some affection of those organs, than that they should be mistaken for a hernia. The history of the case usually removes all doubt as to its nature.

Treatment. The palliative treatment of reducible oblique inguinal hernia consists in maintaining perfect and unintermitting retention of the hernia; for if this be done carefully and with method, a permanent cure may be effected, especially in children. The cases of hernia into the vaginal process, if carefully treated immediately after the first appearance of the rupture, and before the walls of that canal have been stretched for any length of time, are sometimes cured by the employment of a well-adjusted truss. But in the use of this instrument before puberty, great attention must be given to the site of the testis; for the pad of the truss might press injuriously upon that organ. The spring of the truss must not be too powerful; for if the pressure of the pad upon the walls of the abdomen is very strong, their tissues are absorbed where the pad presses, and they become, in consequence, seriously weakened. The pad should prevent the escape of the hernia by its accurate adjustment, rather than by the force with which it presses against those apertures through which the hernia passes. On this account, each individual requires to have a truss adapted to the configuration of the body. The pad should be applied over the internal inguinal ring, pressing gently upon the inguinal canal to afford support to the tissues of that part, and not upon the external inguinal ring and pubes, as we have often seen it applied. The patient should be enjoined to wear the truss uninterruptedly, except only when lying in bed; to adjust it carefully before leaving bed in the morning, and on no account to permit the hernia to remain for a moment in the sac.

When the hernia has acquired large dimensions, or has become irreducible, a particular form of appliance, termed the bag-truss, becomes indispensable.

The radical cure of reducible inguinal hernia. The mode of performing the operation as practised by Wutzer is as follows (a special instrument is required, which consists of two pieces of wood and a flexible needle):

The patient being placed in the most favourable position, and the rupture carefully reduced, the fore-finger of the operator is used to invaginate the intestuments and to push the fundus of the sac into its orifice. The cylindrical wooden plug is next inserted in place of the finger, and the needle thrust through the invaginated skin, sac, anterior wall of the inguinal canal, and skin of the groin. The grooved piece of wood is then laid over the inguinal canal, held in position by the needle, and screwed tightly to the first piece, in order to induce adhesion between the tissues thus compressed between them. The plug is retained for seven or ten days, according to circumstances: after its removal, a pad should be adjusted to support the part, and prevent the extrusion of the invaginated tissues.

The commonly unsuccessful issue of the operations performed on the principle of invagination, as advocated by Gerdy, Wutzer, and others, induced Mr. Wood to search for the cause of failure. This he attributes to the want of union between the invaginated tissues and those lying behind them. The theory of Wutzer's operation is to induce adhesion between the fundus of the hernial sac and the entire circumference of its orifice, as well as entire obliteration of the other parts of the sac by adhesive inflammation. Unfortunately, however, the results of practice do not uphold the theory.

Mr. Wood* has contrived an operation by which he believes the chances of

* *On Rupture, Inguinal, Crural, and Umbilical, &c.* by John Wood. 8vo. Lond. 1863.

failure above mentioned are prevented. The operator requires a special needle, scalpel, compress made of wood, glass, or porcelain, and some strong hempen thread. The contraction of the abdominal muscles should be completely controlled by the influence of chloroform.

After an incision has been made through the skin of the scrotum, the forefinger of the operator is pushed behind the hernial sac as far as possible into the inguinal canal, and in front of the spermatic cord, at the same time invaginating the tissues. The needle is next carried by the side of the finger and passed through the conjoined tendons of the internal oblique and transversalis muscles, the inner pillar of the external inguinal ring, and the integuments. Great care is required to avoid including the spermatic cord. A thread is next passed through the eye of the needle, and the latter is withdrawn, leaving one end of the thread in the puncture. The needle, still threaded, is next passed through the aponeurosis of the external abdominal oblique muscle near to Poupart's ligament, and opposite to the internal inguinal ring, and its point brought out through the opening in the integuments first made by it. A loop of thread is left behind, and the needle, with the thread still in it, is again passed through that portion of the conjoined tendons which lies over the rectus muscle, close to the pubic spine and the inner pillar of the ring. Its point is now brought through the first puncture for the third time, and the needle altogether withdrawn from the thread.

Thus a loop and two ends of thread pass through one opening in the skin. "Two portions of thread are thus placed across the hernial canal, invaginated fascia and sac, closely embracing, but not including, the spermatic cord, and connecting the posterior or deep wall with the anterior or superficial, perforating the aponeurosis of the external abdominal oblique muscle in three places; but escaping by the same aperture in the skin" (Wood). The compress is next applied over the canal obliquely, and the two ends of the thread passed under the loop and tied in such a manner as to give equable adjustment to the pressure.

The after-treatment of the case is the same as that adopted in similar operations.

Mr. Wood describes several modifications of this operation in which wire was used with good results.

The taxis. When a Surgeon has a case of irreducible inguinal hernia to treat, his attention should be particularly devoted to a very careful examination of the tumour, in order to diagnosticate the variety under observation. He should ascertain with accuracy the anatomical relations of the tumour to the surrounding parts; the position of the testis, especially; the length of time the patient has been ruptured; the mode of development of the hernia, whether suddenly or slowly; the treatment pursued to prevent the protrusion from taking place; and the history of the present state of the rupture.

Having determined the variety, if the state of the tumour permit, he may employ gentle pressure in order to reduce the protrusion, remembering the direction or course it has taken, and the circumstances which probably cause the impediment to its reduction. The abdominal muscles must be relaxed as much as possible whilst the patient lies on the back.

It is only necessary to describe, in this place, the manipulative proceedings, as the constitutional measures employed to render them more effective have been detailed at page 262. A very much larger proportion of the cases of inguinal hernia are now reduced by taxis than formerly. This is due to the introduction of chloroform, the effects of which in producing total annihilation of the contractile function of muscular tissue are so important. Small inguino-scrotal protrusions are not reduced with the same facility as large ones. When such a protrusion occurs in a young person, and has been only recently developed, after a fair trial of the taxis, when the patient is fully under the influence of chloroform, and the efforts to reduce it have failed, any delay in removing the impediment to the replacement of the hernia is reprehensible. To resort to any other measure which necessitates the occupation of time, is only to abandon the sufferer to additional risk of the loss of life.

If the protrusion be compound, that is to say, when it consists of a large

mass of omentum and a very small knuckle of bowel, the reduction of the latter is effected with difficulty. The same thing occurs when the hernia is one of irreducible omentum of long standing, from old adhesions, and a small piece of bowel. Also, when the sac is distended and rendered very tense by a considerable effusion of serum. The efforts of the Surgeon to reduce the bowel are thereby rendered abortive; for if the serum cannot be made to pass through the mouth of the sac, into the abdomen, the hernia never will.

The operation. The patient should lie on the back, with the pelvic region slightly elevated, unless some firm, resisting body, as a mattress, cushion, or table, be underneath. The anatomical points which the Surgeon particularly wishes to reach or display in the cutting operation are, the external inguinal ring, the aponeurosis of the external abdominal oblique muscle, the internal inguinal ring, and the mouth of the hernial sac. The various structures which constitute the coverings of the hernial sac need not be displayed with rigorous anatomical precision. They differ exceedingly in density and development in different cases. The length of the incision should not be proportioned to the size of the hernia. Its length must be just sufficient to expose freely the anatomical points, alluded to above, and no more. In ordinary cases, the point of the scalpel should be inserted through the integuments at about two inches above the assumed centre of the external inguinal ring, and carried downwards upon the anterior surface of the tumour, to terminate about two or three inches below the same mark. The margins of the external inguinal ring are next carefully exposed, and their relations to the tumour examined. They should not be cut unless it be imperatively required to do so. The deeper coverings of the hernial sac are next carefully incised, with or without the assistance of a grooved director, until that important structure is reached.

The operator, pressing his finger upon the sac, next insinuates it through the external inguinal ring, in order to ascertain if there be any structures which firmly encircle the neck and orifice of the sac. Should he discover any, a grooved director may be guided by the finger underneath them, and they may be cut. After slight pressure made upon the sac, its contents may sometimes be returned into the abdomen at this stage of the operation. If their reduction be not practicable, the peritoneal sac must next be opened. It must be done after the manner described at page 274, and with great care. Probably some serum will escape when the sac is cut, but this is not always the case. The opening in the sac requires to be sufficiently large to allow the operator to reach its orifice easily, and to examine its contents. The index-finger is now passed along the anterior surface of the protrusion upwards towards the mouth of the sac, where an impediment to its further passage is encountered. The tissues which bound this narrow opening constitute the impediment to the reduction of the hernia. The operator next passes the hernia bistoury along a grooved director, or upon his finger, through the mouth of the sac, and divides the structures in contact with the knife sufficiently to allow the ungual phalanx to be passed freely into the abdominal cavity. The direction of this incision should be parallel with the linea alba. A few small arteries are occasionally cut during the operation, which may be tied immediately, before proceeding further.

Oblique inguinal hernia in the female sex. This variety occurs at very early periods of life. In fact, with the exception of umbilical hernia, it is the only kind developed before five years of age. Even until the age of puberty it is more common than any other variety. Its development in infancy is due to the patulous state of the vaginal process of the peritoneum, otherwise known by the name of the canal of Nuck. Doubtless such a condition of this process remains throughout early life, into which a hernia occasionally and suddenly descends. In the adult female this hernia generally forms slowly.

Its anatomical relations are alike in both sexes, merely substituting the round ligament in the female for the spermatic cord of the male, and the labium pudendi for the scrotum.

It is commonly believed that inguinal hernia is much more rarely met with in woman than femoral. However, this belief seems to be founded on an error.

Mr. Kingdon's valuable tables show that, in the years 1860 and 1861, 1582 females, at all ages, suffering with either one variety of hernia or the other, came under his observation. Of these, 761 were afflicted with inguinal hernia, and 821 with femoral. Or, inguinal hernia was only 30 less than half the total number, whilst femoral was but 30 more than half.

The tumour formed by an inguino-labial hernia rarely attains the size so often reached by inguino-scrotal. Still, we have seen one which descended more than half-way below the middle of the thigh, and the coverings of which had become so attenuated that the convolutions of the intestines were distinctly visible. When of moderate size, it is generally of a more globular figure, and it has a longer and more contracted, or more narrow and cylindrical, neck, than in the male sex.

In forming a correct diagnostication of this hernia in the female, the same anatomical points must be taken as guides which have been already described when that in the male sex was under consideration. The Surgeon should, however, particularly remember that a hydrocele of the round ligament, or of the canal of Nuck, is occasionally developed, which might lead to an error in diagnosis.

The palliative measures described as being suitable in the treatment of cases of inguinal hernia in the male sex are applicable in these also; but if the hernia become strangulated, the Surgeon must regard the accidents arising from misapplied taxis and delay in liberating the bowel with very great suspicion, and act with promptitude and decision. In the cases we have seen, under these circumstances, the symptoms have usually been rather severe at an early period of the attack; and in those upon which we have been required to operate, the impediment to the reduction of the bowel was at the orifice of the sac, and certainly insuperable without a cutting operation.

In the female sex, the operator must be guided by the same anatomical points in his attempts to reach the mouth of the hernial sac as in the male. And he should remember that, occasionally, although very rarely, the bowel may be constricted by a contraction of the sac itself near the external inguinal ring, and not by its ventral orifice only.

Direct inguinal hernia. The variety of inguinal hernia characterised by the term "direct" occurs in both sexes. It belongs to that class in which the hernial sac is formed slowly, or is an accidental or acquired formation. The only exception to the slow mode of formation is in those rare cases when the structures immediately behind the external inguinal ring are lacerated by violence, and a hernia protrudes. It is never the result of a congenital imperfection. This variety is sometimes styled the internal inguinal, from the fact that the mouth of the sac, where it is continuous with the parietal abdominal peritoneum, is placed to the inside of the internal epigastric artery. It is comparatively rare.

At its commencement it forms a prominence where it points behind the external inguinal ring, through which it soon passes into the upper part of the scrotum. The outline of the tumour which it forms is more globular than that produced by the oblique course of the variety before described. It seems to be produced by something which escapes at once or directly from the cavity of the abdomen. Hence, probably, its specific name. The mouth of the sac is close to the outer border of the pubic attachment of the rectus muscle, the posterior surface of which may be much more easily felt when the hernia is reduced than in oblique. On the outer side of the orifice of the sac the pulsations of the internal epigastric artery may be felt. The finger enters the abdominal cavity much more readily in direct inguinal hernia than in oblique. Upon ocular examination from a short distance it will be seen that a line passing through the vertical or long axis of the tumour lies parallel with the linea alba, and there does not appear to be any inclining or curving of the neck of the tumour outwards and towards the crest of the ilium, as is observed in one formed by oblique inguinal.

In its passage from the abdomen a direct hernia merely traverses that small portion of the inguinal canal which lies immediately behind the external inguinal ring, and those structures which form that part of the floor of that canal

are either pushed before the hernia, or they are lacerated when the hernial sac escapes through the opening so formed. Those structures are the conjoined tendons of the internal oblique and transversalis muscles and the pubic portion of the internal abdominal fascia. The spermatic cord and round ligament are not attached to the hernial sac until it has reached the external abdominal ring. When it has passed that point, they lie to its outer side, and are usually less identified with its tissues than in the oblique variety.

The diagnostication between this variety of inguinal hernia and oblique must be formed under the guidance of the facts before described.

The palliative treatment requires a particular kind of truss, which must be so constructed as to give support to the defective abdominal walls posterior to the external inguinal ring.

The method of exposing and opening the hernial sac to liberate a strangulated bowel does not require any special description here. Facts, however, worthy of note are, that after the division of those structures superficial to the external inguinal ring, the spermatic cord may appear to be unusually distinct, and that the deeply seated coverings of the hernial sac are often very attenuated. Considerable care is therefore required in the operation of incising them.

Inguinal herniæ sometimes pass through abnormal apertures in the aponeurosis of the external abdominal oblique muscle. It would be an oversight not to allude to the fact, that an inguinal hernia sometimes passes through an opening or division of the fibres in the aponeurosis of the external abdominal oblique muscle close to the ring, and not through the true external inguinal ring, which is then traversed by the spermatic cord alone. Such anatomical varieties are rare, and would only require some slight modification of the operation, to meet their peculiarities.

Crural hernia, also called femoral or merocèle, was not accurately distinguished from some forms of inguinal until the middle of the 17th century. Its designation in a measure indicates the region of the body where it forms a tumour, which, however, may be stated, with greater precision, to be the upper and inner part of the thigh. Its anatomical relations were not accurately defined for many years after it was known to pursue a different course to inguinal; and it is curious to follow the gradual development of our knowledge of those structures immediately interested in, or associated with, this variety of rupture.

The principal anatomical points which should be examined, from the outside of the thigh as well as from within the abdomen, are the following: the ligament of Fallopius or of Poupart; Gimbernat's ligament; the crural canal or ring; the fascia transversalis and iliaca, or the internal abdominal fascia of the iliac fossa; the falciform process of the fascia lata and the saphenous opening; and, when a hernial sac exists, the fascia propria of Sir Astley Cooper.*

Relations of the mouth of the hernial sac to the internal epigastric artery and vein. The orifice of the peritoneal sac holds important relations to the internal epigastric vessels. Some pathologists have established three varieties of the ordinary kind of crural hernia on this basis. The first, in which the orifice of the sac is situated to the outer side of the epigastric, external crural hernia; the second, where it lies to the inside of the same vessels, the middle crural hernia, the most common; the third, in which it is placed to the inner side of the remains of the obliterated umbilical artery. The first and third varieties are very rare.

Here we may also state that the obturator artery is occasionally given off from the internal epigastric or femoral, and that when the former vessel lies to

* The anatomy of these various parts must be assumed to be known by the reader. We may, however, allude here to the importance of noticing the structure last named, viz. the fascia propria, first described by Sir Astley Cooper from a dissection made in 1800, and which is still preserved in the Museum of Guy's Hospital (no. 2503). It is an envelope which is found on the outside of the peritoneal sac, usually separated from it by a layer of adipose tissue.

the outside of the orifice of the hernial sac, the obturator artery may cross closely over its neck, and dip down by its inner side to enter the obturator foramen.

Varieties in the course pursued by the sac of a crural hernia. In a memoir published by Dr. Le Gendre he describes four rare varieties of crural hernia.* They may indeed be regarded rather as curiosities, on account of their rarity.

1. The hernia, as soon as it traverses the crural ring, passes directly internal to and behind the femoral vessels, and rests on the pectineus muscle, the aponeurosis of which sometimes forms an envelope to it; this he calls the pectineal crural hernia, on account of its situation, or the hernia of Cloquet, in honour of the Surgeon who was the first to describe it. Callisen, Vidal (de Cassis), M. Richet, Dr. Le Gendre, and Mr. J. Adams,† have recorded similar cases.

2. This variety, although placed internal to the femoral vessels, is, however, rather far from them; it passes through that resisting fibrous structure which bounds the crural canal and sheath internally; that is to say, the ligament of Gimbernat. Laugier, who was the first to notice it, calls it the *crural hernia through Gimbernat's ligament*, or the hernia of Laugier. Cruveilhier, Demeaux, Nuhn, and Le Gendre, have also dissected cases of this kind.

3. This comprehends the variety of crural hernia which Hesselbach has so well described and figured.‡ The hernia in this case traverses several openings in the fascia cribriformis, and then presents several distinct lobes, which give it a characteristic appearance; it is the *hernia with a diverticulum through the cribriform fascia*, or the hernia of Hesselbach. Le Gendre and Malgaigne have dissected examples of this variety of rupture, which the former believes to be not so very rare.

4. Lastly, a variety in which the hernia, after having escaped beneath Poupart's ligament and traversed the cribriform fascia, sends one or more prolongations through the superficial fascia. This variety may be termed the *crural hernia with a diverticulum through the superficial fascia*, or the hernia of Astley Cooper.§ Le Gendre describes a dissection of a case of this kind, and publishes a drawing of it in his work.

We may add a variety described by Mr. Partridge,|| in which the hernia was situated external to the femoral vessels.

Development of the sac of a crural hernia. The peritoneal sac of a crural hernia is always a secondary or acquired formation. It is never the result of a congenital defect. An opportunity of observing the early stage of a crural hernial sac commonly occurs in post-mortem examinations. The point of the finger may be pressed into a fossa, or even a sacculus, of two or three inches in length, between the femoral vein and Gimbernat's ligament. An observer is enabled, in this way, to thrust the parietal peritoneum down upon the thigh at this spot for one or two inches below Poupart's ligament. And this opportunity is most favourable for the study of the relations of the sac of a crural hernia. By degrees such a digital depression of the peritoneum at the crural ring becomes in a living person dilated into a sac by the repeated and continued pressure of the viscus which forms the hernia. The sac extends lower down upon the thigh beneath Poupart's ligament; but, instead of descending lower and lower towards the knee, it usually dilates in a direction towards the crest of the ilium, so that the long axis of the tumour lies parallel with Poupart's ligament and upon the fascia lata. When large, the tumour even overlies that ligament, and seems to occupy the region in front of the inguinal canal. But in every case of crural hernia the tumour is formed by a protrusion which has escaped from the abdominal cavity below and behind Poupart's ligament; therefore the Surgeon is able to trace that structure running along its upper border.

* *Mém. sur quelques variétés rares de la Hernie crurale; avec 6 planches.* 8vo, Paris, 1858.

† *Med.-Chir. Trans.* 1860, p. 127.

‡ *De ortu et progressu Herniarum*, 4to, 1816.

§ *Anatomical and Surgical Treatment of Abdominal Hernia*, chap. xx.; case of Mrs. Sheffield.

|| *Trans. Path. Soc.* vol. i. p. 99.

Crural hernia rarely increases to the size of inguinal. But occasionally, after an operation for the liberation of a strangulated bowel, when the tissues around the crural aperture have been weakened by cutting them, and the sufferer has neglected to employ the support afforded by a truss, nearly the whole of the alimentary canal may protrude. In such cases the walls of the sac become so remarkably attenuated that the peristaltic movement of the intestinal convolutions is distinctly seen through them; so attenuated as even to excite astonishment that the vitality of the integuments should be maintained. A very rare variety, as regards figure, we once saw in a man. The tumour was of a cylindrical shape, and extended downwards and inwards over the thigh, reaching as low as the middle of that region. The great size of the tumour is not a feature of serious importance, for a very small sac, having a contracted orifice, more readily entangles the hernia and prevents its reduction.

Diagnostication; first, from other kinds of hernia. Those with which crural may be confounded are inguinal above Poupart's ligament, and obturator below the horizontal ramus of the pubes. It would seem to be impossible, however, to mistake a crural hernia for an inguinal, or *vice versâ*, if the observer will but carefully trace the outline of Poupart's ligament. But he must remember that the fundus of the sac of a crural hernia sometimes takes a course upwards, and overlies that structure. Nevertheless, the course of Poupart's ligament can be always ascertained with more or less precision; whether an inguinal hernia overlies it from above—a very rare occurrence—or a crural from below, the fingers of the examiner can still trace it from the ilium to the pubes—of course, in one case more distinctly than in another. If the whole of the tumour lies below the ligament, and its neck can be traced continuous with the crural aperture, its contents have escaped beneath Poupart's ligament, and it is a crural rupture; but if the contrary, it is an inguinal, especially too if the neck be traceable to the internal inguinal ring. Crural is distinguishable from inguino-labial hernia by placing the finger on the spine of the pubes, or upon the attachment of the tendon of the adductor longus into that point of bone; for even in very fat persons the pubic spine can be always felt. If the tumour be to its outer side, the protrusion has escaped below Poupart's ligament, in which case it is crural rupture; if, on the contrary, it has passed through the external inguinal ring, it must be an inguinal. The same point of bone will aid in distinguishing between a pudendal hernia and a crural.

A crural hernia is much more superficially seated than an obturator, and in consequence the tumour which the latter produces is neither so prominent nor so well defined as the former. The latter escapes from the pelvis behind the horizontal ramus of the pubes, and therefore Gimbernat's ligament and the crural aperture can be felt. The elevation of the integuments produced by an obturator hernia is certainly in the locality of the crural aperture; but the depth of the tumour is its striking feature, and the facility with which the crural aperture can be felt is pathognomonic of the relations of the protrusion.

Crural hernia requires to be distinguished from other diseases which occur in the same region.

1. From *psaos abscess*. The history of the case, the locality of the swelling, and the results of a palpable examination of the tumour, are quite different from hernia. Psoas abscess is generally preceded by pain in the back, constitutional disturbance, and inability to extend the hip-joint completely without pain. These symptoms do not accompany a crural hernia. Psoas abscess does not burrow down below Poupart's ligament at the crural ring, but to the outer side of the sheath of the femoral vessels. But an infallible test that the tumour is formed by a circumscribed collection of fluid is obtained by placing the patient flat on the back, and then gently applying the right hand above Poupart's ligament and the left below it, or *vice versâ*. When pressure is made upon the swelling with one hand only, the other is elevated; and when the action is reversed, the opposite effect takes place. With this result on manipulation of the swelling, there can be no doubt of the nature of the disease.

2. *Enlargement of the lymphatic glands*. The correct history of the development of the swelling will aid in forming the diagnosis, especially its perma-

nence and progressive increase. If there be a suspicion that the tumour is of glandular origin, it is as well to institute a careful examination of those somewhat secluded regions in which certain specific ulcerations unfortunately occur, giving rise to angioleucitis.

3. *Dilated and varicose veins.* We have seen a dilated vein and a tumour formed of varicose veins occupying the site of a femoral hernia; but the diagnosis was easily made by placing the patient in the recumbent posture, when the swelling disappeared. Digital pressure being made at the crural ring or upon the vein, the swelling was at once reproduced.

4. *Cysts in the superficial fascia.* Cysts are sometimes, although very rarely, developed in the region of the crural ring; in some cases associated with hernia, but sometimes without. The permanency of the swelling, its persistent and invariable size, the fluctuation discoverable on pressure, and the history of the case, are aids to correct diagnosis. When a cyst is present, and there are any symptoms suggestive of strangulated bowel, the propriety of accurately ascertaining the contents of the tumour by an exploration of its interior cannot be disputed.

Palliative treatment. The treatment of crural hernia by the use of trusses is most important. The prevention of the dilatation of the sac is the primary point to which attention should be directed; and this may be accomplished by giving support in the region of the crural ring, especially if it be efficiently maintained.

We gladly avail ourselves of the large experience of Mr. Kingdon in offering a few observations regarding the use of trusses in this variety of hernia. In a truss to prevent the escape of a crural hernia, the spring should fall somewhat suddenly from the point where it passes around the hip, and lie along Poupert's ligament. The pad should be rather small and convex. The cross-strap should fasten high up on the shoulder of the spring, in order to keep the pad well down in the thigh. The thigh-strap should start from near the pad, and return, after encircling the thigh, to the pad itself. When Poupert's ligament, or rather the whole crural arch, is lax, and moves backwards and forwards with the varying size of the abdomen, the pad should press upon that ligament; for then the crural aperture is made smaller, and the rupture more efficiently maintained. For that purpose a larger and flatter pad is wanted. But when the crural arch is strong and steady, the smaller pad is both more effective and, by reason of its smallness, more convenient and less incommodious. Also, it is less liable to displacement by the movements of the hip-joint.

When the rupture is large, or where it comes down under the fascia lata, it is necessary to use a thigh-belt, with a triangular pad projecting on the inner surface, and forming a soft continuation of the pad, to fill the triangular space where the cribriform fascia occupies the saphenous opening of the fascia lata.

Sometimes after an operation, in which Gimbernat's ligament has been freely divided, a cross tongue in addition, to buckle to the free end of the truss, is needed.

Irreducible crural rupture of course requires a hollow pad, whether epiplocele purely, or enterocoele.

Attempts have been made to effect a radical cure of crural rupture by a cutting operation. The patients recovered from its effects; but we have no data by which to arrive at any conclusion as regards the advantages obtained.

Crural hernia is much more common in the female sex than in the male. But the general belief that it is much more common in women than inguinal, does not appear to be founded on facts. The following table demonstrates the proportions in which they occur. The comparative numerical equality is explained by the circumstance, that before puberty inguinal hernia is common, whilst crural is extremely rare. In 193 girls before 15 years of age, Mr. Kingdon met with 184 cases of inguinal rupture, and only 9 of crural. Even to the age of 20 years, the cases of inguinal hernia are much more common than femoral, as the table in next page shows. In a total of 1442 ruptured females, at all ages from birth upwards, the majority of the cases of crural hernia over inguinal was only 54.

After twenty years of age, crural hernia is much more commonly developed than inguinal.

Decades.	Inguinal.	Femoral.
Birth to 10 years . . .	146	1
11 to 20 " . . .	103	37
21 to 30 " . . .	153	180
31 to 40 " . . .	164	252
41 to 50 " . . .	76	158
51 to 60 " . . .	33	84
61 and upwards . . .	19	36
Total . . .	694	748=1442 cases.*
Total cases of femoral . . .		748
Deduct cases between 20 and 40 years . . .		432
At all other ages . . .		316
Deduct cases before 20 years of age . . .		38
After 40 years of age . . .		278

This table demonstrates a fact for which the pathologist will be scarcely prepared, viz. that the largest number of cases of crural hernia is developed during those years usually termed the prime of life, *i. e.* in women between twenty years old and forty.

But it must be observed that this happens to be that period of life when parturition is most frequent, and when consequently the peritoneum and the tissues of the abdominal walls become much stretched by the development of the gravid uterus. Their power to resist the weight of the abdominal viscera becomes diminished; hence a cause of their protrusion.

To ascertain whether there was any relation between the development of hernia and parturition, Mr. Kingdon made the following table of 680 ruptured females, and found the proportion of mothers to be as follows:†

	Inguinal.	Femoral.
Infants and girls under 16 years . . .	87	3
Single women . . .	50	61
Mothers . . .	178	262
Married women who had not borne children . . .	19	20
Total . . .	334	346=680

And next, with a view to ascertain the influence of repeated pregnancies upon the development of hernia, he examined 442 women who had been mothers before discovering the hernia. Of these, 180 women were afflicted with inguinal, 262 with femoral; which gives a majority of 82 in favour of femoral. The influence of the first pregnancy is very remarkable.

442 women had been mothers before discovering the hernia:

	Inguinal.	Femoral.
67 had borne one child . . .	27	40
51 " two children . . .	26	25
53 " three " . . .	22	31
55 " four " . . .	23	32
40 " five " . . .	15	25
25 " six " . . .	8	17
34 " seven " . . .	15	19
	136	189

* This table was made from Mr. Kingdon's reports of the City-of-London Truss-Society for the years 1860 and 1861. It shows the ages of the individuals at the time of first discovering the hernia.

M. Malgaigne states that inguinal hernia is even more common in females than crural. *L'Union Méd.* 1854, p. 154.

† *Report*, 1860, pp. 10, 11.

	In preceding page	Inguinal.		Femoral.
		136		189
30	had borne eight children	13		17
25	" nine "	7		18
19	" ten "	10		9
16	" eleven "	5		11
8	" twelve "	4		4
4	" thirteen "	2		2
10	" fourteen "	2		8
3	" fifteen "	—		3
1	" eighteen "	1		—
1	" nineteen "	—		1
442		180	+	262=442

By a preceding table the fact was demonstrated that crural hernia is most commonly developed between 20 years of age and 40. Now as we know that there is a much larger number of females alive between 20 and 40 years of age than above 40, we might conclude that the number of cases of crural hernia is in proportion to the numbers of the population at any respective age. Under 20 years of age this is certainly not the fact, for the population at those early ages of life is of course the largest, whilst cases of crural hernia are exceedingly rare. The cause of the frequency of inguinal hernia during the early life of females has been before explained (p. 310).

It is highly interesting to compare the frequency of crural hernia at various ages with the numbers of the female population of London at the same periods of life; and in this inquiry we have made use of the census-table of 1851,* and Mr. Kingdon's statistics before alluded to. From those data the subjoined table is arranged:

		Crural hernia.
Females under 20 years	493,260	38
" from 20 to 40 years	453,809	432
" " 40 upwards	308,609	278
	1,255,678	748

This shows the number of cases of crural hernia in a million females—

Under 20 years to be	77
Between 20 and 40	952
Above 40	901

Doubtless this calculation can only be considered as approximating to numerical accuracy; but it seems to demonstrate the truth of the general proposition, that females between the ages of 20 and 40 years are most liable to the development of crural hernia under certain conditions. The cause of this liability is probably due to the natural condition before alluded to, coupled with its attendant circumstances, and the occupations of the class of persons which would apply to public charities; as well as, perhaps, to configuration, and some predisposing causes, or hereditary influences.

Morbid states of the crural hernia. An irreducible crural epiplocele is very often seen; an enterocele in the same state is very rare. With a view to ascertain whether the strangulation of the bowel was in any degree influenced by the accompaniment or absence of omentum, we made an analysis of 61 cases of strangulated crural hernia, which came immediately under our own care for operation. The proportions were equal; there being 31 pure enteroceles, 30 entero-epiploceles.

A reducible crural epiplocele may at any time become inflamed, give rise to local pain, and increase in size. The local application of cold, and absolute rest, are the measures to be employed to prevent adhesion between the rupture and its sac. This condition of an omental rupture in the groin is some-

* Census, 1851, vol i. p. 193, table ii.

times mistaken for angioleucitis. But the history of the case, and the negative evidence derived from the absence of every primary cause of lymphatic irritation, should suffice to remove all difficulty in diagnosis.

Both Pott and Astley Cooper allude to circumstances which are of vital importance in the treatment of crural hernia, viz. the difficulty often experienced in the reduction of small recently-developed enterocoeles, the rapidly extending injury of the bowel, and the severity of the constitutional symptoms which are excited by that condition. But these features have been more fully insisted upon by Mr. Bryant in a careful investigation of the cases admitted into Guy's Hospital.* Out of 142 cases of strangulated crural hernia, only 38 were reducible by the taxis. This, of course, is explicable by remembering that the majority of such cases is not sent to the hospital until the further use of the taxis is evidently unjustifiable. Ten of these cases were of recent development, that is, they were strangulated on their first recognised descent. This is an important feature in crural hernia, bearing especially on the results of treatment in these cases. It is cases of this kind which are so frequently overlooked by the medical attendant. He suspects that the symptoms exhibited by the patient are referable to a rupture, and he asks the question whether there is any tumour to be felt in the groin or elsewhere. Receiving a reply in the negative, he is content therewith. But that should not satisfy him. The Surgeon should carefully examine the crural rings, and the other regions in which a hernial tumour may exist.

The mortality arising in cases of strangulated crural hernia of all kinds is very large; but in those where the bowel becomes strangulated on the first descent, the death-rate is the largest. The experience of a large number of these cases teaches that the bowel should be liberated as soon as possible, and, if the taxis be not successful when the patient is fully under the influence of chloroform, that the cutting operation should not be delayed a moment.

The youngest girl we have heard of suffering with strangulated crural hernia was between eight and nine years old.

Application of the taxis. The patient should lie on the back, with the hip-joint more or less flexed. The Surgeon, taking a position most convenient for the purpose, gently compresses the whole swelling, at first endeavours to diminish its size by pressing any serous effusion that may happen to be in the sac into the abdomen, and next to empty the bowel of its contents. Then recalling to mind the site of the crural ring, he presses the bowel backwards, inwards, and upwards.

The operation of liberating the strangulated bowel by incision. The tissues to be divided to expose the sac are, the integuments, the superficial fascia, the fascia propria, and often a layer or covering of fat. The points to be particularly observed as guides for the safe and certain manipulation of the sac are, first, Poupart's ligament in front and above it; and secondly, Gimbernat's ligament at the pubic border of its neck.

Slight variation in the line, direction, or figure of the incision through the integuments is admissible, according to the inclination of the operator; but for all practical purposes we prefer a linear incision of from three to four inches in length. It should cross over the pubic side of the neck of the tumour, and extend on to the abdomen about one inch above Poupart's ligament. Its form being slightly concave, the neck of the tumour is embraced by the concavity. The integuments and superficial fascia being divided, a well-defined, membranous sac is usually seen, and the operator should next display clearly Poupart's ligament above the tumour, and feel Gimbernat's ligament to the pubic side of its neck. This covering is the fascia propria. Next, he may pass a hernia bistoury, with great care, between the last-named ligament and neck of the tumour, outside the fascia propria, and, directing its sharp edge upwards, cut a few of the fibres of Gimbernat's ligament, or of those which unite the falciform process of the fascia lata to it (Hey's ligament), and thus enlarge the crural ring. This done, the reduction of the rupture may sometimes be effected by

* *Guy's Hospital Reports*, 1861.

the application of gentle pressure upon the contents of the sac. This proceeding constitutes the minor operation. It is simple, safe, and well adapted to cases of recent enteroceles which have been strangulated a very few hours, and when there is reason to believe that the bowel has escaped injury by the taxis. Obviously, therefore, it is only justifiable in select cases.

Failing to reduce the contents of the sac, the fascia propria is next carefully divided upon a grooved director, and a layer of fat is very frequently exposed. Inexperienced operators, mistaking this fat for the omentum, are puzzled when they cannot find the bowel, or they mistake the peritoneal sac for intestine when that is seen upon clearing away the fat. The hernial sac being exposed, it should be traced upwards to the crural ring, and the fascia surrounding it in the crural canal divided; or the division of the structures forming the crural canal having been reserved for this special moment, must now be undertaken, as before described. But the hernia remains irreducible. With great care, and *secundum artem* (p. 274), the sac must now be incised. Through the first puncture a stream of serum usually flows. Empty the sac of the fluid by enlarging the opening sufficiently to reach its orifice. If nothing but omentum be seen, carefully raise it from below or gently unravel it, and towards the mouth of the sac, secreted behind that part of the omentum which has just escaped through its mouth, the bowel will be seen. Next, to enlarge the orifice of the sac, introduce the point of the finger between the protrusion and Gimbernat's ligament; but if that cannot be done, the hernia bistoury must be insinuated in front of the omentum, directing its cutting edge forwards and holding the blade parallel with the linea alba. Having then liberated the bowel from its constriction, it is easily returned into the abdominal cavity. It is not always necessary to cut the orifice of the sac, after having divided the tissues outside of it, as before described. Its tissues frequently yield before the gentle introduction of the finger.

Arrange the wound in such a manner that an opening exists at the lowermost angle for the escape of discharge, and flex the hip-joint by placing a pillow beneath the popliteal region for the limb to rest upon. Any further special detail for the treatment of the case is here unnecessary.

Mr. Kingdon has informed us that the extent to which Gimbernat's ligament is divided is a subject of grave importance as regards the future comfort of the patient. He states that Hey's ligament should rather be cut than Gimbernat's, and that when the latter is at all extensively divided, it is almost impossible to retain the hernia after the thickening, subsequent to the operation, has passed off. Certainly the most prodigious crural hernial tumours we have seen occurred in women upon whom an operation had been performed for strangulated bowel.

Arteries, cut during the progress of the operation, should be immediately tied.

Wound of the obturator artery. This blood-vessel, when it passes to the obturator canal, after dividing from the internal epigastric or femoral, lies close to the neck of the sac, and it has been occasionally cut at the same moment as its orifice. Before using the knife, it might be practicable to feel the pulsations of this artery with the tip of the finger. When cut, an attempt should be made to arrest the bleeding by tying the ends of the wounded vessel.

Omental sacs are most commonly met with in cases of crural hernia. An account of them has already been given at p. 274.

Obturator hernia. The obturator canal is situated at the upper and outer part of the obturator or thyroid foramen, and is bounded above by the horizontal ramus of the pubes, and in other parts by the obturator membrane or ligament and the obturator muscles, which are attached to its internal and external surfaces. The muscle within the pelvis is covered by the internal abdominal fascia, that outside by the obturator fascia. The obturator nerve, artery, and vein pass through the canal from the pelvis to the thigh. The course of the cutaneous filaments of this nerve should be especially noticed; for as its trunk is in close proximity to the hernial tumour, the pressure which the latter makes against it

induces pain in those regions where the filaments of the nerves are distributed. In some cases this fact may prove a valuable aid in diagnosis, as the sequel will show.

This rare variety is described as hernia through the obturator canal, the foramen ovale, the thyroid or obturator foramen, and sub-pubic femoral. In the early part of the last century M. Garengot* called the attention of Surgeons to this kind of hernia, which, after having escaped from the pelvis through the obturator canal, forms a swelling among the adductor muscles and in the pubic region of the thigh. The neck of the sac lies behind the horizontal ramus of the pubes, occupies the obturator canal, and makes its way sometimes between the uppermost fibres of the external obturator muscle, at other times above them. The fundus and body of the sac are covered by the fascia of that muscle. By the dissections of several cases, the obturator vessels and nerve are shown to be differently placed as regards the tumour. Vinson† states that he found the artery six times to the outer side of the sac, six times to the inner side, and three times behind it. The relative position of this artery to the sac probably bears some relation to its origin. In Mr. Stanley's case,‡ both artery and nerve were above the hernial sac; the former to its inner side, the latter towards its outer.

Both sexes are liable to the formation of this hernia, but a large majority of the cases on record occurred in females. The anatomical reasons for this are obvious.

There are cases on record in which this hernia had existed, and in which the viscus was strangulated without any local signs of a tumour. Mr. Hilton's case,§ in which the entire calibre of the ileum was in the sac; and Mr. Tebay's,|| in which only a part was found, are marked illustrations. In Mr. Obré's case,¶ “the eye detected a slight degree of fulness in Scarpa's triangle,” and “a distinct hardness could be felt, slight in its extent.” In the only instance we have seen, the hernia gave rise to a very distinct, well-defined tumour, deeply seated among the adductor muscles, to the pubic side of the femoral vessels. In Mr. Stanley's case,‡ a crural epiplocele existed on the same side as the obturator entero-epiplocele. The latter was, however, extremely small, and produced “no swelling on the inside of the thigh.” The hernia “was found with its peritoneal sac beneath the obturator externus muscle, between the muscle and the obturator fascia.”

The foregoing observations illustrate the difficulties which attend the detection of protrusions through the obturator canal.

We have collected twenty-five of the most recently recorded cases of this variety of hernia, and the remarkable features they present are well worthy the attention of the reader. They may be divided into two classes: the first embraces a large majority, and consists of those cases in which the hernial tumour was not discovered during life; the second, those in which it was discovered by palpable examination, either immediately at the inner side of the thigh, or, as in one instance, only by an examination per vaginam.

In several of the cases of the first class, the tumour produced by the protrusion was so small, that the sac, with its contents, being placed deeply among the adductor muscles and beneath the pectineus muscle, could not give rise to any local external swelling. In two cases the tumour was found between the obturator ligament and obturator externus muscle. The contents of the sac in six cases consisted of only a portion of the calibre of the canal of the intestine. This had, however, become converted into a diverticulum, in some instances of considerable length. We meet with this condition of the hernia occasionally in other regions, but the cases are not common; and we may therefore conclude that, in proportion to the rarity of obturator hernia, this may be considered to be

* *Mém. de l'Acad. Roy. de Chir.* t. i. part iii.

† Günther's *Lehre v. d. blutigen Operationen*, Abschnitt xv. § 146.

‡ *Trans. of the Path. Society*, vol. iii. p. 94.

§ *Med.-Chir. Trans.* xxxi. p. 323.

|| *Med. Times and Gaz.* vol. ii. p. 270, 1852.

¶ *Med.-Chir. Trans.* xxxiv. p. 233.

one of its remarkable features. In one case, the Fallopian tube and ovary formed the contents of the sac; in another, a portion of the urinary bladder.

The hernial sac, which is never wanting, consisted always of a portion of the parietal peritoneum of the pelvis thrust through the canal, and tolerably firmly attached to the parts with which it was in contact. The sac was therefore slowly formed. On this account some of the patients had experienced, during the development of the hernia, repeated attacks of bowel derangement, evidenced by symptoms of obstruction, termed colic pains, uneasiness at the inner and upper part of the thigh, and even cramp or spasmodic pains in the muscles of the femoral region, and which extended down the leg.

In a large number of the cases, the acute pain in the course of the obturator nerve, described by the patient, was a marked feature of the case, and pressure over the site of the external aperture of the obturator canal gave rise to paroxysms of pain of great severity. It is due to the tact of Mr. Howship* to state, that he seems to have been the first writer to dwell particularly upon this fact, which some years afterwards was strongly insisted upon by Romberg.† The only patient we have seen with this variety of hernia complained bitterly of feeling a sudden pain at the upper and inner part of the right thigh, which extended thence down the inside of the limb to the knee, front of leg, foot, and great-toe.

The cases of the second class are those in which the tumour was discovered during life, either in consequence of its bulk, or by a careful examination of the region in which it was developed. Dr. Roeser‡ proposed that advantage should be taken of the rectal passage of the male, and the vaginal of the female, to institute a more searching examination of the obturator region within the pelvis; and by this means Dr. Lorinser, in 1857, discovered an obturator hernia.§ Mr. Nuttall, of Leicester, in the same year, in a case in which not even fulness of the adductor fossa was perceptible, was induced, by the severity of the constitutional symptoms of strangulated bowel, and the pain caused by local pressure made directly upon the obturator region, to explore that part; and his judicious treatment was rewarded by the discovery of a very small hernial tumour, the contents of which were returned into the abdominal cavity by gentle pressure, without incision of the sac.|| Before this Mr. Obré had successfully operated upon a case of strangulated obturator hernia, in 1851, in which "the eye detected a slight degree of fulness in Scarpa's triangle, on the right side;" this triangle of the opposite limb being well marked with a hollow or depression passing down its centre, but which was lost on the affected side. Also, on pressing firmly "a little below the saphenous opening, a distinct hardness could be felt." Lastly, in the case successfully operated upon by Mr. B. B. Cooper, in 1853, the woman being very thin, there was both ocular and palpable evidence of an indisputable nature. At first sight, the swelling in Scarpa's triangle seemed to be identical with that which might be produced by a protrusion through the crural canal; although it had not the appearance of being in close relation with Poupart's ligament, for it formed a somewhat globular fulness, rather than a circumscribed tumour. Then the point of the finger could be placed in the crural ring, which of course was conclusive evidence that the hernia had not escaped through it. Really, therefore, there were no practical difficulties to prevent the formation of a correct diagnostication in this case. We may here state that these observations are made from notes of the case taken personally at the bedside of the patient.

Complications. But we must allude to a class of cases, of which there have been several instances, in which the existence of an obturator hernia was complicated with the development of other kinds, especially those in the inguino-

* Howship's *Practical Remarks on the Discrimination and Appearances of Surgical Disease*, 1840, p. 323. Prep. in Mus. Coll. Surg. no. 1359.

† Romberg, in Dieffenbach's *Operative Chirurgie*, b. ii. p. 621, 8vo, Leipzig, 1848.

‡ *Archiv f. Phys. Heilkunde*, 1851, p. 142 et seq.

§ *Lehre v. blutigen Operationen*, Abschnitt xv. § 147.

|| *British Medical Journal*, p. 566, 1857.

femoral regions. In one case there was a reducible crural hernia on either side; in three cases, a crural hernia on the same side as the obturator; in one case, on the opposite side; and in another case, an inguinal hernia on the same side as the obturator.

The treatment adopted in three of these cases was that which most Surgeons would approve. The symptoms of strangulated intestine being clearly marked, an exploration was made of the hernial sacs, which were visible and tangible, in the expectation of finding a small knuckle of bowel retained within them. But nothing of the kind being found, the examination was not prosecuted further; although, in two of the cases, an obturator hernia, seated immediately beneath the site of the operation, was proved, by after-death examination, to have been the cause of death.

As a possible complication, we must here allude to the fact that, in some of the cases, in the same individual, a sac was found to pass through both right and left obturator canals.

In fourteen of the cases the obturator hernia was not discovered until after death. In one case the symptoms indicated the existence of this variety of hernia, and the patient recovered without any interference on the part of the Surgeon. In ten of the other cases the protrusion through the obturator canal was discovered during life; and the treatment adopted and its results we may briefly describe. In one case the protrusion was reduced after the application of the taxis by Dr. Roeser, of Bartenstein. This was in a female thirty years of age, rather corpulent, who had been frequently troubled with intestinal disturbance. By careful manipulation a small tumour was felt over the external aperture of the left obturator canal, upon which pressure caused great pain.* In another case, Dr. Roeser was not so successful in the treatment. This was a male, fifty years old, who had been frequently troubled with pains in the abdomen, called colic. The case was rendered obscure by enlargement of the inguinal glands on the same side as the hernia; nevertheless, Dr. Roeser diagnosed the obturator rupture, and partially reduced it. The man, however, died, and after death a part only of the wall of the intestinal tube was found in the sac.† In one case the obturator hernia was discovered during life after the performance of gastrotomy.‡ Dr. Arntz saw a woman, sixty-two years old, when she had been suffering three weeks. He discovered and diagnosed an obturator hernia, the integuments over which were inflamed and becoming gangrenous. He made an incision; the contents of the tumour escaped; and the patient died next day.§ The accuracy of the diagnosis was verified after death.

Dr. Heiberg operated upon a woman, fifty years old, after distinctly feeling an elastic swelling in the left adductor region. Upon this tumour he cut down, opened the hernial sac, stretched the obturator canal with his finger, and returned the bowel. The patient, however, died.|| Mr. Heath, of Newcastle, operated upon a woman seventy-five years old. The tumour, although small, was perceptible; the pain on pressure and down the limb very characteristic. The sac was opened, its orifice cut, and a piece of dark-coloured intestine returned. The aged patient survived the operation thirty-six hours, and the commencement of the attack about four days.¶ Dr. Nuttall, of Leicester, being called to a woman, aged seventy-five years, suffering with well-marked indications of strangulated intestine, but without any tumour in the usual site of hernial protrusions, was led, in consequence of pain being produced in that part when he pressed in one particular spot, to diagnose an obturator hernia, although there was not even "fulness" perceptible, over the site of the obturator region. He cut over this painful spot, found a small tumour, exposed the hernial sac, and reduced its contents by gentle pressure. This old woman survived thirteen

* *Archiv f. Phys. Heilkunde*, 1846, § 408.

† *Ibid.* 1851, § 142.

‡ Mr. Hilton, *Med.-Chir. Trans.* 1848, vol. xxxi. p. 323.

§ Günther's *Lehre v. d. blutigen Operationen*, Abschnitt xv. § 148.

|| *Ibid.*

¶ *Lancet*, 1857, vol. ii. p. 109.

days. After death, the bowel which had been strangulated was found in process of repair. An obturator hernial sac was seen on both sides.*

We have now to describe the cases which have been cured by operation. Mr. Obré seems to have been the first Surgeon to cure a case of strangulated obturator hernia. This was in 1851. In a woman, aged fifty-five years, tall and stout, he diagnosticated a strangulated hernia of this kind. He cut down upon the swelling, incised the sac and its orifice slightly, and returned a small piece of blue congested bowel.†

In 1853 I assisted Mr. Bransby Cooper in an operation he performed at Guy's Hospital on a woman, forty-nine years old. She was exceedingly emaciated, had given birth to twelve children, and was affected with bronchitis. She was not aware of being ruptured. For sixty-two hours before coming to the hospital she had been suffering with strangulated intestine. Her illness began with a sudden pain at the upper and inner part of the right thigh, and extended from that spot along the inside of the thigh, knee, front of leg, and to the great-toe. Upon examination of the region below Gimbernat's ligament, a deeply seated swelling was felt. Mr. Cooper made an incision over the tumour, divided the pectineus muscle, and reached the hernial sac. Gentle pressure was made upon it, and the contents passed readily into the abdomen. She slowly recovered, and the wound entirely healed; but before she left the hospital she was seized with acute bronchitis, which caused her death.

Dr. Lorinser, in 1857, discovered an obturator hernia by an examination per vaginam. The age of the patient is not stated. On the eleventh day after the commencement of the attack, he cut down upon the tumour, opened the sac, and found the contents in a state of gangrene. A fæcal fistula was established, which subsequently closed, and the woman survived the operation eleven months.‡

We believe that we have now given a brief but instructive summary of the cases on record from which useful practical lessons may be derived. There are more instances published, which have been discovered after death, and therefore simply attest the fact of the existence of the disease.

Mr. Kingdon believes he has met with five cases of obturator hernia in living persons. Two of them were in men; in both, the femoral artery was in front of the swelling, and pushed forwards at each forced expiration. The men were past forty years of age, thin and gaunt. He does not recollect whether the femoral artery was pushed forward in the female, whose case he otherwise well remembers; but he distinctly recollects that he was able to feel the bony rim at the upper edge of the aperture through which he had returned the hernia. The woman was emaciated to the last degree of voluntary locomotion.

We propose next to select the most prominent facts from the whole number of cases, with an especial view to the diagnostication of those cases in which there may not be any palpable or ocular evidence of a rupture.

Diagnostication of an obturator hernia,—from its position. After passing along the obturator canal, it emerges upon the thigh below the horizontal ramus of the pubes, to the inner side of the capsule of the hip-joint; behind, and a little to the inner side of the femoral artery and vein; and to the outer side of the tendon of the adductor longus. The tumour formed by the protrusion is covered by the pectineus muscle. From crural hernia, therefore, it may be distinguished by observing the relative positions of the horizontal ramus of the pubes and of the femoral artery. Those structures occupy, in fact, a position between these two kinds of hernia. In obturator hernia they are in front of the tumour; in crural hernia they are behind it. In the former, then, they are easily felt; in the latter they cannot be without difficulty—not, perhaps, until the hernia be reduced. In those cases in which either a fulness, slight hardness, tumefaction, or swelling exists, coupled with well-marked indications of obstruction or strangulation in some part of the alimentary tube, the difficulty of diagnosis is not so very great;

* *Brit. Med. Journal*, 1857, p. 566.

† *Med.-Chir. Trans.* 1851, vol. xxxiv. p. 233.

‡ Günther's *Lehre v. d. blutigen Operationen*, Abschnitt xv. § 147.

but how much embarrassment arises when those symptoms which betoken strangulated bowel exist, and a tumour is nowhere to be felt, let the numerous cases on record, in which the rupture has only been found after death, attest.

Assuming, for the sake of illustration, that we have before us a patient suffering with well-marked constitutional indications of strangulated bowel, and that, after the most careful examination of all those apertures through which ruptures more commonly escape, we have failed to detect any palpable tumour to assist in explaining them, how are we to discover an obturator protrusion, or obtain sufficient evidence of the probable existence of one to justify an exploration of the obturator region by means of the scalpel? We reply, By pain during the development of the hernia; by pain at the commencement of the present attack; by pain of a peculiar character during the progress of the illness; by pain referred to the course of the cutaneous filaments of the obturator nerve and the plexus formed with it, and the internal cutaneous and its distributions; by pain excited by certain definite movements of the hip-joint; by pain induced by local pressure carefully applied; and by pain when an examination of the pelvic orifice of the obturator canal is made *per vaginam*.

We shall now describe these important indications with a little more precision. During the formation of the hernia, some of the patients had suffered at irregular intervals with constipation, nausea, and pain resembling colic in the pelvic region; and one woman related how upon repeated occasions she had suffered thus, and felt relieved directly after experiencing a sensation as if something slipped back into the abdomen at the lower part. In Mr. Hilton's case, some months before the fatal attack from hernia, on the left side, the patient had suffered with symptoms of bowel-obstruction and pain referred to the right side. After death a right obturator hernial sac was found, "more distinct than on the left side, large enough to admit freely the fore-finger."

One patient narrated, in a very striking manner, how she had been suddenly seized with a violent pain at the inner and upper part of the thigh. Soon afterwards, nausea, followed by vomiting and all the other indications of strangulated bowel, existed.

In several of the cases there appears to have been something very characteristic in the nature of the pain. Admitting the difficulty of meeting with any two or more persons who would describe pain so closely resembling each other's sensations as to prove an infallible guide, yet that described during the progress of the illness seems to afford some clue in these cases. It is described as spasmodic contraction of the abdominal muscles, and not as pain within the abdomen. For the explanation of this phenomenon, we may refer to the association existing between the cutaneous filaments of the obturator nerve, which are irritated by the pressure of the tumour in the obturator canal, and the muscular filaments distributed in the abdominal muscles; for all are branches of the lumbar plexus.

The pain described by several patients, in both instances, when a hernial tumour was palpable, as well as when it was entirely concealed, could not have failed to attract the notice of the Surgeon to the distribution of the cutaneous filaments of the obturator nerve, and the more internal of the internal cutaneous. In this fact we have a most valuable aid to the diagnosis of some abnormal pressure upon its trunk, as it traverses the obturator canal. Certain definite movements of the hip-joint may subserve very usefully in diagnostication, as, for example, when there may be some doubt on which side the protrusion exists, or when it chances to be so small as to be under the influence of the obturator muscles, when only in a violently contracted state. We may therefore employ the actions of these rotators of the femur outwards, to compress the tumour, and thus excite pain; and by comparing the influence of these muscles on both sides of the pelvis, valuable aid might be obtained. It has been demonstrated after death, that in some cases the protrusion passes between the fibres of the external obturator; and therefore we may suppose that they could readily compress the neck of the tumour. Want of space prevents further detail; we must therefore leave the adoption of this test, and the method of employing it, to the intelligence of the Surgeon.

In several cases the effect of local pressure over the external outlet of the obturator canal has been to cause acute pain, and even the detection of slight fulness or hardness when no other sign existed at the site of the protrusion. But even this examination should be made with great discrimination. A careful distinction must be made between pain caused by pressure on the obturator nerve and on a hernial protrusion; the muscles, especially the pectineus, must be relaxed; and a comparison of the results of the same amount of pressure on the two sides of the body in the same locality should be instituted with proper precautions. The femur should be supported by an assistant in a position of slight flexion, with rotation outwards, and between abduction and adduction.

The pelvic aperture of the obturator canal may be reached from the vagina in the female, and from the rectum in the male. In cases of difficulty and doubt, therefore, some assistance may be gained by taking advantage of the opportunities these passages afford for the necessary examination.

Accuracy in diagnosis being of paramount importance, we cannot conclude this part of the subject without alluding to the great advantage to be derived from carefully comparing the outline of Scarpa's triangle on both sides of the body; and of impressing upon those who may happen to have a case of suspected obturator hernia under examination, the practical value of seriously reflecting upon all the features of the case referable to nervous derangements, as aids to diagnosis in these most perplexing and difficult cases.

Treatment. Should a hernia be detected, the application of pressure to the tumour may succeed in reducing it. The pressure should be directed in such a manner as to free the hernia from the ramus of the pubes, and pass it underneath it.

Failing to do this, or even with a well-grounded suspicion of hernia, the Surgeon should explore the region below Poupart's ligament. The incision through the integuments should be either parallel with the trunk of the femoral artery, or with the fibres of the adductor longus muscle. It must be sufficiently far inside the artery to avoid the femoral vein. It may commence a little above Poupart's ligament, at a point midway between the spine of the pubes and the spot where the femoral artery passes over the ramus of that bone. The fascia covering the pectineus muscle being exposed, perhaps the hernial tumour may be felt; and if not, pain on local pressure may incite to a deeper prosecution of the search. This fascia and the pectineus muscle being divided in the line of the original incision, or its fibres being separated with the handle of the scalpel, some fat and the fascia of the obturator muscle are reached. As yet, however, the tumour has not been felt; nevertheless it may still be there, under cover of the fibres of the obturator muscle. These must be separated; for it is not until the finger can be placed upon the outlet of the obturator canal that the search for the hernia should be abandoned as hopeless. Care must be taken to avoid cutting the filaments of the obturator nerve.

How far the Surgeon would be justified in making an examination of the opposite side, after having failed to find the hernia on the one first explored, is a proposition we must leave to the judgment of those who may happen to be placed in such an unpleasant dilemma.

We conclude with this observation of Camper: "*Forsan frequentiores sunt, quam quidem creditur, in ileo igitur ad omnis generis herniarum possibilitatem necessario attendendum est.*"

Perineal hernia. The sac of this hernia is formed of the peritoneum, which in the male lies between the prostate gland and rectum, and in the female between the vagina and rectum. In both sexes, when the hernia fills the sac, there is a tumour in the perineum. This kind of hernia is most common in women, and usually consists of a portion of the alimentary canal, of the omentum, or of the urinary bladder.

The sac of a perineal hernia escapes between the anterior fibres of the levatores ani, and is covered by the internal abdominal fascia of that region of the pelvis.

The protrusion of the hernia may be prevented by using a T-shaped bandage.

Pudendal hernia. Pudendal hernia forms a small elastic tumour in the labium pudendi. It lies in the posterior and inferior half of that organ, and forms a somewhat elongated projection at the side of the vagina.

The neck of the sac is placed between the ascending ramus of the ischium on the outside, and the vagina on the inside.

This hernia may be developed at the early age of 22 years (Sir A. Cooper); and in this case it had existed some months.

The tumours in the labium, which may be confused with this hernia, are those formed by inguinal protrusions and collections of fluid. Of the last are cystic formations and hydrocele of the round ligament. These, however, are never reducible; they are not diminished by pressure, and they slowly increase in size from their first appearance.

From inguinal hernia it is distinguished by its position, shape, and relations. It has not passed through the external inguinal ring, but lies parallel with the axis of the vagina. It does not form a pyriform tumour in the labium, but a somewhat rounded mass. It lies by the side of the ramus of the ischium, and not over the body of the pubes.

From crural hernia it is distinguished by the neck of the tumour being placed entirely to the inside of the ramus of the ischium and the muscles attached thereto.

A suitable bandage is required to support the protrusion.

Vaginal hernia. This hernia is usually developed in women who have borne several children. It is only covered by the peritoneum, and that portion of the walls of the vagina which protrudes. The orifice of the sac is usually large, and readily yields to pressure. Consequently it is easily reduced, and, with the exception of the discomfort and annoyance it causes, it is not attended with urgent symptoms. The rectum and urethra may, however, become so much compressed, that inconvenience, and sometimes suffering, may arise from this cause.

The protrusion requires to be replaced in the pelvis, and the necessary support to maintain it there is afforded by making use of a suitable bandage.

When the urinary bladder forms the rupture, which occasionally happens, great distress arises from a constant desire to micturate. The urine becomes ammoniacal, and the bladder so irritable, that a few drops of urine frequently escape, causing intolerable inconvenience. Attention is therefore required to improve the condition of this secretion, and the rupture must be at the same time supported.

Ischiatic hernia. This kind of hernia escapes through the ischiatic notch, and forms a tumour beneath the glutæus maximus muscle. The neck of the sac is either above or below the pyriformis muscle, but generally below it. The fundus, at first covered by the glutæus muscle, as it extends further out of the pelvis, escapes below the edge of that muscle, and lies under the integuments.

When the hernia is in the sac, it forms a tumour of variable size, soft, tense, yielding, reducible on pressure, and causing more or less pain.

Should the hernia become strangulated, and the operator be required to enlarge the mouth of the sac, Sir A. Cooper advises that the incision be carried directly forwards.

JOHN BIRKETT.

DISEASES OF THE URINARY ORGANS.

UNDER the term *urinary organs* will be here comprised the kidneys, ureter, bladder, prostate, and urethra.

It is extremely desirable, when dealing with any disease the symptoms of which are referred chiefly or entirely to some limited portion of the important system defined above as urinary organs, to possess an intelligent acquaintance, not merely with any part which may be especially liable to suffer morbid changes, but with the system itself as a whole. It is absolutely necessary to the formation of a correct diagnosis, to be familiar with the intimate relations which exist between each portion of that system, as well as with the various peculiarities which each is prone to exhibit when influenced by disease. Few things conduce more to error in estimating symptoms than a too exclusive specialism in the observation of disease. The study of stricture and of other forms of urethral obstruction, of vesical diseases, of calculous formations, and of those chronic changes in the secreting structure of the kidney which are conventionally assigned to the province of the physician, must be pursued together if the Surgeon is properly to appreciate the import of any one of these affections. For example, suppose a Surgeon about to perform an important operation upon the bladder or urethra (and what operation there is not important?), who is unacquainted with, or is at least indifferent to, the chemical and microscopical characters of his patient's urine, will any one, who is himself acquainted with those indications of the condition of the kidneys which these characters reveal, deny that elements most important to the formation of a correct diagnosis, and, therefore, to an appropriate therapeutical scheme, must be absent from the mind of the Surgeon in relation to that case? It may be replied, that the necessary information can be obtained from the physician. Ought the Surgeon to be dependent for an acquaintance with the facts required upon any other observer in such a case? Assuredly not: not only is the knowledge easy to attain, and convenient to possess, but it may be safely held that the Surgeon who views with equal intelligence the lesions, both functional and organic, which affect the kidneys, the bladder, and the urethra, will be, *ceteris paribus*, the safest and most successful ad-

viser in the ailments of any one of those viscera. The relations which mutually subsist between each of the series, not only by contiguity, but by other and less obvious connexions, are so numerous and constant, that a study of the whole can alone qualify the practitioner intelligently to treat disordered function in any part thereof. I do not hesitate to affirm, that no man can deal adequately and safely with cases of impaired urinary function, whose hand is not well trained to the use of the sound or catheter, whose eye is not familiar with urinary deposits in all their varieties of crystals, corpuscles, and renal casts, and who is not acquainted with their indications so far as these are known, as well as with the significance of those subjective phenomena which are found accompanying them. The exploring sound is quite as essential to the diagnosis of urinary disease as the stethoscope is to affections of the chest. He who is a physician only, will (and does) constantly overlook calculus and stricture, to the great detriment of the patient; while the mere surgical handicraftsman will (and does) treat mechanically many a case which can only be injured by his manipulations. With these views, the careful study of all acute and chronic renal affections is recommended to the student who desires to qualify himself specially for the practice of surgery.

The following is a table of those renal affections which necessarily come under the observation of the Surgeon, in connexion with the diseases of the bladder, prostate, and urethra, which so frequently demand his services. The limit assigned to the department of urinary disease in this work forbids more than the slightest glance at them; it appears, therefore, the more necessary to make these introductory remarks.

THE KIDNEYS :

Malformations.

Injuries (vol. ii. p. 421).

<i>Inflammation</i> (nephritis),	{ traumatic, idiopathic, and by extension.
" <i>acute</i> ,	{ calculous.
" <i>chronic</i> ,	{ from obstruction in the passage below.
" <i>of pelvis of kidney</i> (pyelitis).	{ calculous.
" <i>acute and chronic</i> ,	{ from obstruction.
	{ diathetic.
	{ calculous.
	{ scrofulous.

Calculous nephralgia.

Abscess of kidney and fistula.

Perinephritic abscess.

Tumours of kidney.

Suppression of urine.

Hæmaturia.

Malformation. There are few deviations from the normal conditions which can be regarded as malformations, and these are unimportant to the Surgeon. It is only necessary therefore to enumerate the ordinary varieties. (1) There may be only one kidney, which is then usually larger than natural; it may lie in its usual place, or may in reality consist of the two organs joined in the median line, and occupy a position in front of the vertebral column. In the last-named condition the form is sometimes that of a horse-shoe with its convexity downwards. (2) One kidney may occupy its ordinary situation, and a second may be movable, forming a tumour recognisable during life; or it may be fixed in an unusual situation, generally lower than natural, or within the pelvis. (3) The kidney may present an outline more or less lobulated, showing the persistence of a form existing in foetal life, and natural in some of the lower animals.

Nephritis. Acute and chronic.

Acute nephritis, of a severe form, is common in surgical practice. It exists also as a sequel to preëxisting chronic inflammation of the kidney, and in Bright's disease.

The causes of the first-named variety, with which almost exclusively we have to deal here, are as follows:

Wounds, bruises, and strains; by extension from the bladder in cases of calculus, stricture, and cystitis, following operations or otherwise; retention of urine, causing distension of the ureter and fluid pressure on the kidney; renal calculus; entozoa; extension of inflammation from neighbouring parts, as diseased vertebræ, &c.; diuretics in over-doses; cantharides and turpentine; exposure to cold; and alcoholic drinks. It will be observed that many of these causes act almost exclusively on the male, and in connexion with surgical affections. In the female, nephritis is more commonly associated with uterine diseases.

Symptoms. The first is usually an attack of rigors; nausea, often vomiting, prone to be obstinate, generally soon succeed. Pains in the back and loins, dull and heavy, sometimes lancinating, increased by the upright position, by coughing and vomiting, even by respiration, and often extending along the ureter. Occasionally there are aching or numbness in the thigh of side affected, and tenderness on pressure in the renal region, sometimes considerable. Micturition is frequent; the urine is mostly high coloured and scanty; neutral or alkaline; often mingled with blood, and then becoming albuminous, not otherwise; later in the disease it may

be purulent. Under the microscope renal casts may be found containing pus and blood-corpuscles. Sometimes total suppression occurs. General signs of fever are present, as heat of skin, dry furred tongue, headache, thirst, quick and hard pulse. Anasarca often appears also, in cases suddenly occurring from exposure to cold; not commonly in cases of extension from the bladder.

In the latter instances, suppuration in the substance of the kidney is to be dreaded; the symptoms are then more intense, there is great depression of the vital powers, and fatal coma often occurs by uræmic poisoning. If pyelitis accompanies or supervenes on nephritis, there is also generally pain and retraction of the testicle on the affected side.

As it is impossible to include in this work a history of all the renal and allied affections with which the Surgeon should be familiar, a few remarks will follow here on the differential diagnosis of nephritis, so as to illustrate the leading characters of those other diseases which might be confounded with it.

The *diagnosis* is not generally difficult, although in a few instances it may be obscure. If a patient, who has suffered long from urethral or vesical disease, or who has recently undergone an operation for stone or stricture, suddenly shows signs of an acute febrile invasion, with vomiting, pain and tenderness in the renal region, scanty urine, or urine mixed with blood, there can be little doubt of the presence of acute nephritis. When there is no history of previous urinary complaints, an attack of primary acute nephritis may sometimes be confounded with the following affections: calculous nephralgia; pyelitis, simple and calculous; perinephritis; perinephritic abscess; spinal disease, or abscess of the psoas or adjacent parts; lumbago; renal neuralgia and hysteria; inflammation of the bladder; vesical calculus.

1. *Calculous nephralgia*; by which is intended the pain and systemic disturbance occasioned by the descent of a calculus from the kidney to the bladder, and which sometimes resembles very closely acute nephritis. Indeed, excepting only the severe febrile symptoms, all those of nephritis are present. There is acute pain, generally limited to one side, and shooting along the loins to the sacrum, with retracted testicle; but the invasion is more sudden, and the pain more acute, than in nephritis. There may be vomiting, frequent micturition, and bloody urine; but the constitutional disturbance, although it may sometimes be present in moderate degree, certainly falls short of the fever which always accompanies the inflammatory affection. If the calculus obstructs the pelvis or

ureter for any length of time, symptoms of calculous pyelitis may arise. And lastly, all the phenomena may suddenly disappear, which confirms the diagnosis of calculus.

2. *Acute calculous pyelitis* may be distinguished by the following characters: the pain in the back is excessively severe and lancinating, much more so than in nephritis; shooting pains are felt in the groin and inner part of the thigh, radiating to the testicle, which is generally strongly retracted. When the pyelitis is unaccompanied by renal affection, the urine is often acid; and although it may be scanty at first, is subsequently voided in natural quantity. It may have much pus and epithelium mixed with it, and sometimes blood; if so, these matters are found in intimate admixture with the urine. The course of the complaint is less rapid than that of nephritis, and there are frequently considerable intervals of freedom from pain.

3. *Perinephritis; caries of spine*. Inflammation of the tissue surrounding the kidney does not generally make its appearance with an acute attack. The subsequent formation of matter, if it takes place, is accompanied by febrile symptoms; but the gradually increasing swelling, in its later stages presenting fluctuation, while at the same time the urine is healthy, is significant of simple perinephritic abscess, provided the special signs of spinal disease are absent. If, on the contrary, there has been marked tenderness on pressure or percussion at one spot over the vertebral column, and, *à fortiori*, if there exists angular curvature, if there has been any interference with the functions either of sensation or of motion, the spine is obviously the seat of disease. When abscess of the psoas exists independently of the signs of spinal disease, there will generally be noted some disturbance in the nerve-function of the corresponding thigh; and at the same time the motions of the hip-joint will be impaired by the inability to act, from the loss of power in the psoas muscle. Pain on pressure also is more marked in front than behind, the reverse occurring in perinephritis, and sometimes in nephritis.

4. *Rheumatic affection* of the dorsal muscles, or lumbago, is usually productive of great pain, on any effort being made which necessitates the slightest movement of these muscles, much more so than in nephritis; pains also often exist elsewhere, but vomiting and other constitutional signs are absent. Again, the urine is neither suppressed nor materially altered in character; it may be more than usually acid, but it is not alkaline.

5. *Renal neuralgia* is met with, but chiefly in women. Very severe pains are complained of by individuals of nervous and hys-

terical temperaments, which it does not require very acute observation to separate from nephritis. The condition of the urine, mostly pale and abundant, the absence of constitutional symptoms, and the existence of mental excitement, will be sufficient to mark these cases.

6. *Acute cystitis* is sometimes attended with phenomena which seem to indicate that the kidney is the seat of disease. There may be present great pain in the renal regions, and febrile symptoms of severe character; but also in the pubic and perineal regions; and there are supra-pubic tenderness and suffering in passing water, while the urine, which is usually acid, exhibits abundance of small flakes of exudation-matter floating throughout, and is clouded, yet has only traces of albumen and no blood mixed with it. It may contain pus, and be alkaline; but this is generally as the acute subsides into the chronic form of disease. In later stages of severe cystitis the urine becomes bloody.

7. *Calculus of the bladder* is sometimes attended with an aggravation of symptoms which may be mistaken for acute nephritis. All the local and much of the constitutional disturbance of the latter complaint may be produced, as their rapid subsidence seems to indicate, from mere temporary irritation of the kidney, occasioned by the presence of calculus in the bladder. An examination of the previous history and symptoms, of the urine itself, and the speedy relief which follows simple remedial means, will indicate the real cause, respecting which the sound subsequently employed at the proper time will enable us to clear up any doubts which may still exist.

Treatment of acute nephritis. It is of importance at the outset to insure free action of the liver and bowels, which are often very obstinate. In addition to active purgatives, enemata are recommended; but distension of the colon with irritating fluids is undesirable, and emollient injections alone are admissible; thus, turpentine should be avoided, lest absorption should irritate the kidney. Perfect rest in bed, and low diet, are to be enjoined. Local bleeding by leeches or by cupping is very serviceable: by the latter mode ten or twelve ounces may be taken, and the bleeding may be repeated with advantage if the patient is hale and the attack severe; otherwise, it should be followed by dry cupping, daily or on alternate days. The utility of antimony and salines (generally more or less diuretic) is questionable, and the repeated administration of diuretics is contraindicated; the moderate use of simple diluents, water, linseed-tea, barley-water, or milk-and-water, is preferable. Free action of the skin should be promoted by hot baths or large hot fomentations. For the vomiting, when obstinate and distressing, hydrocyanic acid and kreosote fail, though sometimes successful in mild cases; but counter-irritation to the loins and pit of stomach affords better results; a constant supply of ice in the mouth also helps to allay it. When head-symptoms appear, the most efficient remedies are purgation and renewed counter-irritation over the renal region; similar applications should be made to the temples and to the nape of the neck, with hot bottles and sinapisms to the feet and legs. In apply-

ing counter-irritation, cantharides should not be employed, on account of its known irritant action on the kidney, in some cases even by endermic application; the desired result may be attained equally well by chloroform, ammonia, mustard, or more slowly by nitrate of silver. If either of the two former are selected, dilute with equal parts of spirit; soak a piece of lint the size desired and lay on the surface, covering instantly with oiled silk, and making gentle pressure; in a few minutes the full effect will be seen. In later stages of the complaint, internal stimuli and support may be necessary.

Where acute nephritis first shows itself, as is often the case in surgical practice, by extension from the urethra or bladder in a debilitated subject, the general principles enumerated above must guide the treatment, but actual depletion is rarely permissible. All unnecessary irritation of the urinary apparatus must be avoided, and no catheters passed, if they have been necessary before, unless absolutely demanded by the exigencies of the case, and then with the utmost care and gentleness. If following lithotripsy, all mechanical interference must be suspended, and catheterism used only to relieve an obvious retention. If suppuration take place in the kidney, or the urine be suppressed, little can be hoped for from treatment; active counter-irritation of the renal region and internal stimuli must be perseveringly employed while any hope exists.

Treatment of the attack of calculous nephralgia. The hot bath; antispasmodics and opium liberally administered; cupping to the renal region, and hot cataplasms afterwards; mild diuretics, particularly the decoction of the couch grass or triticum repens; abundance of diluent drinks. Sometimes the occasional inhalation of chloroform, to relax the muscles for a period of ten to twenty minutes, has been of service.

Treatment of chronic pyelitis. If occurring from obstruction in the urethra, the most efficient treatment consists in overcoming it, and enabling the urine to pass freely, so as to relieve the dilated and diseased pelvis of the kidney from distension and pressure. At the same time, the purulent discharge is sometimes diminished by full doses of buchu, and small doses of cubebs and the balsams; sometimes by mineral acids. Abundant nutriment is generally necessary. If the complaint depends on calculus in the kidney, and an examination of the urine or the history has indicated pretty clearly the nature of the formation, appropriate remedies can be taken with the view of dissolving it or at least of hindering its increase. Such are alkaline salts, as the citrate of potash in uric acid calculi, and acids mineral or benzoic for those which are phosphatic. All sources of local irritation must as much as possible be avoided, as sudden or violent movements of the body, and irregular habits of all kinds. Wherever the signs of general malassimilation are present, especially those of the tuberculous diathesis, the appropriate constitutional treatment must be enjoined. Scrofulous pyelitis is, however, rare.

Abscesses may be formed under these circumstances; also as the sequel of nephritis; they should not be opened until the tumour points and the diagnosis is perfectly clear. Often they are perinephritic, although originated by disease within the kidney itself; occasionally a calculus may be removed through the opening made. If not opened sufficiently early, these abscesses may make their way internally, or along the sheaths of muscles, and open in the groin or elsewhere. They may heal soundly, or give rise to renal fistula.

It is necessary to bear in mind that other tumours in the renal region may be confounded with abscess, such as cystic disease of the kidney; simple fluid distension of the pelvis; accumulation of blood in the same situation; encephaloid and tubercular deposits, and

hydatid cysts adjacent to the kidney; besides abscesses, which are the effects of spinal caries. Among these, ordinary cystic disease affords no very obvious signs: the character of the urine may be unaffected; if the cyst is large, dulness on percussion is present. Distension of the pelvis with fluid may be due to retained urine, or merely serous fluid, and may in very rare cases afford the sense of fluctuation externally. If there is a partial communication with the ureter, the amount of water passed will differ greatly on different days. Cancer of the kidney is encephaloid in six cases out of seven; the pain is severe, the growth rapid, the tumour extremely large and abdominal; hæmaturia is present, and the diathesis is generally marked. Tubercle in the kidney rarely produces a tumour appreciable during life, and its symptoms point much more to the bladder than to the organ affected; tubercle in the lungs, and elsewhere, usually coexist. Tumours containing blood are almost invariably recognised as originating from direct violence, or from a strain in violent exercise. Tumours containing acephalocysts are very rare; they are usually in connexion with the pelvis of the kidney, and may exist for a very long period without rupture, subsequent to which hooklets, &c. are found in the urine. In rare instances, both these and the tumour produced by great distension of the pelvis of the kidney have been successfully punctured.

Chronic nephritis is not always a well-marked disease, except as a sequel of the acute attack, not including under the term that constitutional state of which the most marked sign is the admixture of albumen in the urine, and which is ordinarily known as Bright's disease. Here the kidney is, strictly speaking, perhaps secondarily affected; but the fact of its degeneration may be always noted in advanced stages. It is of the utmost importance that the Surgeon should be familiar with its phenomena, as, in dealing with diseases affecting the bladder or urethra, the presence of Bright's disease is a circumstance of grave import, which may greatly influence the treatment required by the other affection; nevertheless, its purely medical character as a blood disease must exclude its consideration here.

The remedial means for simple chronic nephritis consist in local stimulating applications to the renal region, avoiding specific renal irritants, before specified, combined with the constitutional treatment of chronic inflammation.

Renal calculi. (See the essay on CALCULUS.)

Hæmaturia signifies simply the presence in the urine of blood; which may exist in any quantity, from an amount discoverable only by the microscope, up to that in which it constitutes the major pro-

portion of the fluid passed by the urethra. It is a symptom, merely, of disease in some part of the urinary organs. When blood is present in small proportion, and has been in contact with the urine for a considerable time, the latter presents a peculiar brownish colour, characteristic to the practised eye, and commonly known as the "smoky tint." If in large quantity, under similar circumstances, the mixture has the appearance of thick or muddy coffee. The source of the blood in hæmaturia may be any one or more of the following parts: the kidney, the pelvis of the kidney, the ureter, bladder, prostate, or urethra.

Hæmaturia occurs in acute and chronic diseases of the kidney; from injury, as by blows, strains, &c.; from calculus in any part of the urinary tract; from violent diuretics, as turpentine or cantharides; in cystitis sometimes; in prostatic disease; in malignant disease of any part of the urinary organs; in villous tumours of the bladder; in the hæmorrhagic diathesis; and in certain states of the blood, as in fever, purpura, and allied conditions; in stricture of the urethra; from chordee; from the local application of mechanical and chemical agents.

It is always important to determine its source; the following hints will assist in forming a correct diagnosis:

Renal hæmorrhage, not being traumatic, is usually preceded or accompanied by some signs of kidney-disease; which is most frequently acute desquamative nephritis, and renal casts are usually found in the urinary deposit; the blood is always intimately mixed with the urine, which shows the smoky tint. Further, it may be said, as a general rule, that such urine passed without pain, or any other local symptom whatever, is more likely to derive its blood from the kidney than elsewhere. Hæmaturia from a calculus impacted in the pelvis or ureter is associated with the history and signs of the occurrence (see Calculous Nephralgia). Hæmaturia caused by a blow on the back is mostly from the pelvis or ureter. Malignant disease occasioning hæmaturia presents sooner or later some physical characters associated with the organ which is affected.

Blood derived from the neck of the bladder or prostate generally remains within the cavity, and if in large quantity forms a clot there, perhaps distending the viscus; or the urine has the colour of porter, and a darker sanies comes away at the close of micturition. When altogether from the prostate, a portion usually issues unmixed with urine by the urethra. In malignant disease of the bladder or prostate, disintegrated shreds of tissue come away with the urine, and occasionally cancer-cells (so called), and the blood is apt to appear suddenly in large quantity. In villous tumour, characteristic shreds of

that growth are sometimes detached; in both this and the preceding case the bleeding is large, and its occurrence irregular, but it is much less so in the latter case than in the former. With villous growth the blood is more intimately mixed with the urine, which is constantly more or less stained. The appearance of a drop or two of almost unmixed blood at the end of passing water may be caused by either calculus or chronic prostatitis; the history, the distinctive symptoms, and the sound will determine which. When the hæmaturia is due to urethral sources, and these are numerous (such as injury to the penis from blows or lacerations, and in falls, with or without fracture of the pelvic bones; chordee; occasionally from rupture in sexual intercourse; from surgical instruments; in some forms of stricture, from severe efforts to pass water; impacted calculus; sometimes in severe gonorrhœa; phagædenic ulceration; and malignant disease), it will be found that although blood is often mingled with the urine, it generally issues from the urethra in a pure state, unmixed with the contents of the bladder, and at other times than during the act of micturition; long and slender clots, also, forming casts of the urethral canal, are often voided.

It is necessary to take care that the colour of the secretion in the alleged hæmaturia is due to blood. Bile, rhubarb, and other colouring matters, also mere concentration, will produce a dark and reddish tinge. The disappearance of the colour by heat, and the precipitate of albumen, indicate blood; but the microscope determines it without fail. For minute quantities, often a matter of extreme importance to identify, in connexion with calculus in its early stage and in other circumstances, the detection of the blood-corpuscle by means of the microscope is the only certain method.

Treatment. Renal hæmorrhage must be treated, when due to calculus, malignant disease, and violence, by absolute rest, in the recumbent position, and by internal styptics, such as gallic and sulphuric acid, and acetate of lead, combined with opium; when produced by purpura and Bright's disease, by iron and other appropriate remedies. Hæmorrhage of the bladder may demand similar general management, if it is considerable; but local means are here more powerful. Thus ice should be applied to the perineum and hypogastrium, the patient maintaining perfect quiet in bed; a little ice-cold water may also be injected into the rectum. It is recommended that a catheter should be passed into the bladder, the clot broken up, and that efforts to remove it should be made by applying an exhausted gum-bottle, or syringe, to the instrument; but such interference is undesirable, unless absolutely necessary from retention of urine. The breaking up or otherwise disturbing a clot is liable to open orifices of vessels closed by recently deposited fibrin, and to provide a fresh cavity into which more blood may be poured. Besides, there is no ground for regarding the clot as a great evil, which must be got rid of at all hazards. The solvent power of urine, possessing a temperature of about 100° Fahr., is very great, and is probably the most efficient and the safest agent in effecting the purpose.

It does happen, though very rarely indeed, that mechanical means must be adopted to remove firmly adhering coagula, and the bladder has even been opened above the pubes for that purpose; in almost all cases it is wiser to allow nature to do the work, than to be officious in rendering assistance. The distress occasioned to the patient by the urgent wants to micturate is greatly relieved by the use of opium either by mouth or rectum. When it is necessary, however, to use an instrument, a full-sized catheter should be passed, and a syringe, or stomach-pump, adapted to it, by means of which a considerable portion of clot may be gently withdrawn. It should not be forgotten that Sir B. Brodie records a case in which, all other remedies having failed, a dose of Ruspini's styptic, administered internally two or three times in the course of twelve hours, was followed by complete cessation of the bleeding.

Suppression of urine. This term applies only to a condition in which the kidney fails to perform its function of secreting urine. The bladder is empty, or having been emptied, continues so, since it receives no more by the ureters. Meantime the materials of the excretion accumulate in the blood, and the vital powers become oppressed; a comatose state ensues, and finally death, unless the eliminating function of the kidney is resumed, and the urine again excreted. This function is sometimes totally, but only temporarily, suspended; more commonly it is after long impairment by chronic disease gradually extinguished. Advanced chronic disease existing, any sudden shock from operation, however slight, from acute attack, &c., may rapidly induce fatal suppression. The two conditions of suppression and retention have been much confounded. None, however, can be more distinct: in the former the bladder is empty, in the latter it is unnaturally full; in the former no urine is secreted, in the latter the secretion goes on as usual, but some obstacle opposes its removal from the bladder. The symptoms are these: the patient usually complains of languor; fever, vomiting, more or less pain in the back and loins; he is unable to pass urine, or only a very small quantity: he soon becomes drowsy, perhaps delirious, then comatose, and dies in from two to four days if suppression remains complete. There may be anasarca, but often there is none. Catheterism shows that the bladder is empty.

Treatment. Local cupping; but if the patient is in low condition, without abstraction of blood; hot fomentations and counter-irritation to the renal region. The hot-air bath and free purgation, to aid in eliminating excreta from the system. I have seen, in one case only, recovery after forty-eight hours of complete suppression. In the later stage of chronic renal disease, little is to be hoped for from treatment.

The Ureters present very little occasion for notice.

Malformations. The most common deviation from the natural condition is that of increase in number; two or three ureters may issue from one kidney, and may be continued down to the bladder, but much more frequently unite to form one channel. Sometimes

one ureter only exists; sometimes the ureter is incomplete, and forms a canal with a closed extremity. None of these conditions possess interest from a surgical point of view. The ureter is liable to inflammation, which extends by it from the bladder to the kidney. It may be the subject either of stricture or of obliteration, which conditions are generally produced by injury caused by the passage or impaction of calculi; occasionally from pressure by a tumour; rarely from external injury. It is often greatly dilated, when obstruction exists at the neck of the bladder, or in the urethra, from hydraulic pressure slowly acting upon it; and sometimes to such an extent as to become a supplementary reservoir to the bladder. It has even been seen prolapsed into the bladder, forming a tumour there. It may be the subject of malignant and tubercular disease by extension downwards from the kidney, or upwards from the bladder. A calculus is sometimes arrested in its passage through the ureter, occasioning great agony (see Calculous Nephralgia).

THE BLADDER.

Malformations. These are happily not very common, since, of whatever kind, they are the source of great discomfort, and even of misery, to the subjects of them.

1. Absence of the bladder. The organ is sometimes, although very rarely, absent. (*a*) The ureters have been seen to communicate directly with the urethra; in one case these ducts were somewhat dilated before entering it, in another this condition was not noticed. This abnormality has been only observed in the male sex. (*b*) Less rarely the ureters have been found entering the rectum, and discharging the renal excretion entirely by that channel. These instances have chiefly, although not entirely, been discovered in the male. (*c*) A few instances are on record in which the ureters opened directly into the vagina.

2. Two or more bladders, it is said, may co-exist in the same subject as a congenital malformation. Two cases only are recorded which have any title to be so regarded: one of these occurred in a man in whom the ureter of each side appeared to have its own distinct bladder, the two reservoirs being closely united to each other at their adjacent surfaces (Blasius); the other in a woman who is reported to have had five bladders, five kidneys, and six ureters (Molinetti). Other cases reported as belonging to this category were evidently examples of sacculation resulting from long-standing disease. Sometimes the organ appears to be partially divided by a septum, or to be formed of two more or less symmetrical lobes; but

it is probable that many of these cases, affirmed to be illustrative of malformation, are in reality also the effects of disease.

3. Extroversion of the bladder. This is the least rare of all the vices of conformation to which the organ is subject. In these cases the anterior wall of the bladder is wanting, while frequently, but not invariably, the pubic symphysis is absent also. The posterior wall and base of the organ are then pushed forward by the abdominal viscera, and form a red and vascular flattened prominence, covered by mucous membrane, in the situation of the pubes. The extroverted portion is in the adult usually about the size of the palm of the hand; the orifices of the ureters may be seen just below the centre, and from beneath the lower margin a short imperfect penis projects, which is flattened, as if cleft in the median line, into the urethra. At the root of the penis a rudimentary prostatic structure exists, the ducts of which can be seen opening into the angle between the bladder and pubes. There is usually more or less hernia of the bowels on either side and beneath the extroverted bladder, into a pouch-like fold of integument, which is covered with hair, represents the scrotum, and contains the testes. The mucous membrane is very sensitive, readily bleeds when touched, and from the projecting orifices of the ureters urine is almost continually distilling over its surface. This condition produces much excoriation of the skin on the parts beneath, besides infecting the patient with a continual urinous odour. The malformation thus described affects both sexes, but appears to be more common in the male. Of eight cases which I have personally examined, two only were in the female. From the condition thus described, there are some slight peculiarities of detail in different cases; but most conform very much to the characters given. The defect is of a less serious character, sexually considered, in the female, as the generative function does not necessarily remain in abeyance; the male, however, is, from the condition of the penis, wholly incapacitated for its exercise.

Treatment of malformations. The results of extroversion may be palliated by well-adapted mechanical means; an artificial reservoir may be employed, but great nicety of fit and capability for adjustment in various positions of the body must be attained by the mechanician. Little can be said, from the results of past experience, in favour of the employment of operative measures to remedy these defects. Mr. Simon, of St. Thomas's Hospital, has attempted, in a male case, to turn back the orifices of the ureters into the rectum; but with results which could scarcely be considered successful, although approximating thereto. Other cases of operation have been fatal. In the female the nature of the operation required is less formidable, inasmuch as the indication is rather simply to cover the bladder than to alter the course of the ureters. Dr. Daniel Ayres, of Brooklyn, U.S., appears to have succeeded in covering the extroverted bladder of a young woman with integuments bor-

rowed from the neighbouring parts of the abdomen.* The operation consisted in bringing down a flap of skin from the part above, and turning it down over the bladder below, so that the cutaneous surface was in contact with the mucous membrane, and in bringing up the integuments, previously raised by dissection, from each side of the vulva towards the middle line to meet the flap described. The result obtained was a covering to the bladder, and a small opening for the exit of the urine, which admitted with ease the application of an efficient apparatus to retain it. But Mr. Holmes has recently succeeded in covering the part by lateral flaps, in a young male child. Incontinence exists of course as before; but an instrument may now be easily contrived to catch the urine, and he no longer suffers pain or abrasion by friction. I have examined this patient, and consider the improvement beyond question. (See *Lancet*, 1863, vol. i. p. 714.)

Injuries of the bladder. (See vol. ii. pp. 479 et seq.)

Diseases of the bladder. In entering upon a consideration of the numerous affections which range themselves under this heading, I shall adopt the following classification for the sake of perspicuity. We shall study first those diseases which present local anatomical characters, establishing the nature and extent of the lesion which has given rise to the symptoms observed; and, secondly, those more obscure diseases in which similar symptoms occur, but which do not necessarily or generally involve any organic structural changes.

1. Diseases which involve organic structural changes, the existence of which is generally recognised during life, and is always appreciable after death. These may be arranged as follows:

<i>Inflammation</i> (cystitis):	Acute . .	{ due to injuries and operations.	
		{ " presence of foreign bodies (calculi, &c.).	
		{ " prolonged retention of urine.	
		{ " extension from urethra or kidney, or	
		{ supervening on chronic cystitis.	
		{ " external cold.	
		{ " chemical irritants taken by mouth.	
		{ " " injected into the bladder.	
		{ as a sequel of acute.	
	Chronic (a with, and b without, catarrh):	as the result of obstruction to out- flow of urine from	{ stricture of urethra.
			{ tumours in urethra.
			{ bar at the neck of the bladder.
			{ enlarged prostate.
			{ calculi or other foreign bodies
			{ in urethra.
			{ tumours of penis itself.
		{ from foreign bodies in bladder.	
		{ " growths in bladder.	
		{ " altered urine.	
		{ " paralysis.	
		{ " over-distension or atony.	
		{ " displacement.	
		{ " disease of neighbouring organs (uterus,	
		{ rectum, &c.).	

* *Congenital Exstrophy of the Urinary Bladder.* By Daniel Ayres, M.D. New York, 1859. Prof. Pancoast, of Philadelphia, also operated, with partial success, on an adult male; who however died of a fever before the completion of the treatment.

Suppuration of the bladder.

Abscess of the bladder.

Ulceration, simple and non-malignant, and gangrene.

Vesico-intestinal fistula.

Hypertrophy and sacculation of the bladder: dilatation.

Vesical hæmaturia. (See Hæmaturia.)

Tumours and growths { 1. Fibrous { warty.
 2. Villous or vascular. { polypoid.
 3. Malignant.

Tubercle of the bladder.

Bar at the neck of the bladder.

Hernia of the bladder.

Foreign bodies in the bladder.

Calculi. (See the essay on that subject.)

Inversion of the bladder.

Rupture of the bladder. (See section on Stricture.)

2. Conditions which do not necessarily involve organic structural changes appreciable by known methods of observation, and sometimes associated with some injury or derangement of a nervous centre.

Paralysis.

Paralysis.

Atony from over-distension, caused by { organic obstruction to outlet.
retention of urine, voluntary or in-
voluntary, no organic obstruction
being present.

"Irritable bladder" (i. e. act of micturition abnormally frequent).

"*Spasm of the bladder*" (i. e. contractions of the bladder involuntary, and exceedingly painful).

Perverted sensibility of the neck of the bladder, or neuralgia.

I shall then consider separately certain effects on the function of micturition produced by the above-named diseases, viz.

Incontinence of urine { in youth.
in advanced age.

Habitual engorgement of bladder, and overflow of urine (stillicidium urinæ).

Retention of urine.

Inflammation of the bladder (cystitis): acute. The anatomical seat of inflammation of the bladder is almost invariably the mucous membrane; occasionally, by duration or by intensity of the process, the cellular and muscular tissues external to it may be involved, and perhaps sometimes the peritoneal; but there is no evidence whatever of the existence of any separate and independent inflammation limited to or chiefly affecting the middle and outer coats, as they are anatomically termed.

The mucous membrane, situated near to the internal meatus of the urethra or neck of the bladder, is most frequently, and often most severely, affected. It is so particularly in that very common form of cystitis, viz. cystitis by extension from the urethra, as in

gonorrhœa. In the most severe forms the whole of the lining membrane is affected. This may be found after death simply injected and reddened, or thickened also; or it may have become more or less dark, of a chocolate hue, or even slaty in colour, as when the action has existed for a considerable period of time. Occasionally some lymph is exuded, and membrane-like shreds or patches, and sometimes even an extended layer of this organised product, may be found slightly adhering to the whole surface. In very rare instances such a false membrane has become the cause of retention of urine, and necessitated puncture of the bladder in the male; in the female it is sometimes thrown off entire.

Causes. The traumatic are numerous. Injuries such as blows, and pelvic fractures; operations of lithotomy, lithotripsy, and ordinary catheterism; injections: in the female, prolonged and instrumental labours; mechanical irritation of calculus; the chemical action of cantharides and of some mineral poisons, and strong diuretics; action of the urine itself, retained and decomposed, as in stricture and prostatic enlargement; inflammation of adjacent parts, as kidneys, prostate, rectum (?), urethra, especially the last, giving rise to a common but mild variety; from chronic preëxisting inflammation; rarely from external cold, and occasionally from gout.

Symptoms; of the graver form, occurring after operations and preëxisting chronic disease. The invasion is ushered in by rigors, the signs of general fever, followed by perspiring skin. The desire to pass water is very frequent, sometimes quite uncontrollable; the act is excessively painful, often accompanied by rectal pain and tenesmus. Pain is constant behind the pubic symphysis and in the perineum; also in the sacrum and loins; sometimes in the groin and upper part of the thigh. There is tenderness to supra-pubic pressure, often on the lower half of the abdomen, the patient's legs being raised to relax its parietes; much pain is produced by rectal examination, still more by catheterism. The urine is at first high-coloured, scanty, and clouded; then obviously reddish, like the washings of raw meat; soon purulent and loaded with shreds; while the blood-tint continues, perhaps deepens. Meantime the patient's condition becomes low; he is often delirious; and if the disease is not checked, he dies in from seven to fourteen days. The attack is frequently fatal.

The symptoms of the milder form, which occurs by extension from gonorrhœal inflammation of the urethra, are chiefly local. They are, painful irritability of the bladder, sometimes very distressing; supra-pubic pain; pains in the sacrum, perineum, and thighs; loss of appetite, but not always marked fever. The want to pass

water must be complied with instantly, and is extremely painful. The urine is cloudy, and deposits more or less mucus and pus. It may be fairly supposed that in this group of symptoms the mucous membrane of the neck of the bladder is chiefly affected, and not that of the entire viscus; the most common termination is resolution; while in the more serious form described above, the whole of the mucous membrane is affected, and perhaps some of the tissues subjacent; it may also become ulcerated or gangrenous in the worst cases.

Treatment, of the milder form. A tolerably active mercurial purge at the outset. Leeches to the perineum, if the attack is rather severe, followed by hot poultices, and perfect rest in bed. Hot hip-baths twice a day, 100° to 105°, or more. A moderate supply of diluent drinks, as barley-water or linseed-tea, with a little citrate of potash, say one drachm daily; no saline diuretics, but small doses of antimony, at the outset only, if the attack be severe. Hot linseed-poultices to the hypogastrium, if there is much pain there. If the irritability of the bladder is great, half-drachm to one-drachm doses of the tincture of hyoscyamus every two or three hours should be taken until it is mitigated; this failing, opium and hyoscyamus suppositories or small enemata may be administered. The diet should be light but not lowering. As the acute stage passes off, the effect of buchu may be watched, in one or two ounce doses four times a day, and then of small quantities of tincture of cubebs in addition, or of capivi, giving twenty minims of the former, or five to eight of the latter, thrice daily. In the severe form, the treatment advised above is to be adopted at the commencement; but if the general fever heightens, and symptoms of depression appear or threaten, support and alcoholic stimulants must be given freely, and large hot local fomentations, constantly maintained, should be substituted for the hip-bath; morphia, by the mouth, is usually necessary to tranquillise the system, with warm enemata daily to unload the bowels. Retention must be watched for, and the catheter, a soft gum elastic one, employed if necessary; but never unless it be really required. If there are signs of renal inflammation, the appropriate local treatment must be vigorously applied.

Cystitis resulting from cantharides locally or internally absorbed comes on usually within two to four hours after the dose; the symptoms resemble those of gonorrhoeal cystitis, soon reach their maximum of intensity, and subside in from six to twelve hours. When at the worst, the spasmodic ejection of the urine, as soon as a few drops have accumulated in the bladder, is excessively painful. If the dose has been large, blood appears in the urine, but not otherwise; sometimes shreds of lymph also. The treatment consists in bicarbonate of potash and full doses of hyoscyamus every half-hour for three or four hours, and perfect rest; all movements of the body aggravate the symptoms. It is highly important, if a blister has been the cause, to remove it at once, and to sponge well the surface in order to detach every particle of the cantharides which may be adhering to the skin.

Chronic cystitis. Of all urinary affections, this is one of the most common, since it is apt to complicate almost every other at one time or another. Its causes also are numerous and varied. First of all, on the subsidence of the acute form, a chronic condition commonly supervenes, and may continue for a very considerable period. Next, all forms of obstruction to the exit of urine produce chronic cystitis, by confining the urine until it becomes slightly decomposed,

and consequently irritating to the mucous lining of the bladder. This condition is intensified if the contractions of the bladder are also unusually frequent and painful. Inability to empty the viscus, from paralysis or atony, when no obstruction is present, acts in a precisely similar manner. If the urine is unduly acid or alkaline; if it be loaded with deposits from the kidney; sometimes if diluted or watery; if it be morbid, as in Bright's disease, or charged with irritating matters, such as diuretic salts, &c.,—chronic cystitis may be induced. Foreign bodies in the cavity of the bladder powerfully excite this disease; also tumours of all kinds, simple and malignant. Diseases of the rectum sometimes, such as piles, prolapsus, and cancer, those of the uterus also, by causing pressure, and *à fortiori* when implicating the coats of the bladder, are among well-recognised causes. The bladder is sometimes, although rarely, displaced by adhesion to neighbouring parts, as to the intestine, usually to a portion of the lesser bowel; or it may be forced into a hernial protrusion: in either case its contents are partially retained by pressure, and thus produce more or less of the affection in question.

The structure affected is the mucous membrane lining the bladder; rarely is any other implicated. After long-persisting inflammation, especially the catarrhal, it is thick, velvety, and dark in colour, its vessels being loaded, while the underlying fibres are usually hypertrophied. Chronic or subacute cystitis appears in two distinct forms: the first, an ordinary inflammation, in which a more or less active hyperæmia, hypersensibility, and very slight increase of secretion, are the main elements; the second, often a condition succeeding to this or to the acute form, in which a passive or congestive hyperæmia from local debility in the capillaries, some hypersensibility, and an *inordinate secretion of mucus* mingled with pus in varying quantity, mark the complaint. The latter form is popularly recognised as catarrh of the bladder, and is sometimes called also cystorrhœa.

The first, or *simple chronic cystitis*, is in fact the condition which exists in most cases of irritable bladder, be the cause what it may. Wherever undue frequency in micturition exists, together with increased mucous secretion or with pus, from the bladder, however small the amount, and by the microscope it may always be detected (the signs of the acute disease being absent), there is present subacute or chronic cystitis. Any source of irritation in or near the bladder may give rise to it; and the cause being removed, the effects generally soon cease also. Ordinarily its removal is hastened by rest, hot hip-baths, local fomentation, mild aperients, and sufficient alkali

to neutralise the natural acidity of the urine or nearly so, not to render it alkaline; if necessary, the use of buchu, triticum repens, cubeb, or capivi, in small doses, may be adopted. The second and more severe form of the complaint, however, is that in which the question of treatment becomes wide and important.

Chronic cystitis with increased secretion: catarrh. The condition of the mucous membrane has been already described. Respecting the nature of the discharge itself, much difference of opinion has been manifested by different writers. Its naked-eye characteristics are well known. At the bottom of the vessel into which the urine has been passed, a quantity of semi-transparent, tenacious, ropy material, very much resembling the white of an egg, is soon deposited. On pouring off the contents of the vessel, it is seen at first to adhere to the sides; but soon it slides down in a mass, almost resembling jelly, and then falls out suddenly and heavily. This material has been regarded by some as simple mucus; by others as prostatic secretion; and more recently as merely pus altered by an alkali. None of these descriptions appear to be correct. No doubt it contains a considerable admixture of pus; but it is by no means identical with a specimen of that secretion to which alkali has been added, although there is a strong apparent resemblance between the two products. The mucous membrane of the bladder in these cases appears to secrete, as the bronchial membrane is also prone to do, much of a homogeneous structureless fluid, containing numerous pus corpuscles and young epithelial cells; but the proportion of the liquor to the corpuscle is much larger than in ordinary pus. The old term, muco-pus, describes it perhaps more correctly than any other.

Causes. An attack of acute cystitis; permanent obstruction of any kind, causing retention, stagnation, and decomposition of the urine; calculi and other foreign bodies; tumours in the bladder; spinal paralysis, not only as a cause of retained urine, but as occasioning perverted action of the mucous membrane by impaired nervous supply; and all causes which produce a long-continued irritation of the organ.

Treatment. The inflammation is of chronic and atonic character; depletion and antiphlogistic remedies are therefore contra-indicated. On the contrary, the treatment should be mainly tonic and astringent. It is also more topical than general, since the remedies taken internally appear to act mainly, if not entirely, by their local influence, impregnating the urine which is retained in the bladder. It will nevertheless be advantageous to regard it under two heads, as topical and as general treatment.

1. *Topical treatment*, strictly so called. One important indication in the treatment of this affection is to maintain the mucous membrane of the bladder as free from inorganic or other deposit as is possible. The urine itself also, if alkaline and irritating, must not be permitted to remain in constant contact

with the diseased membrane. It is therefore desirable to introduce the catheter for the purpose, first, of insuring the complete contraction and evacuation of the bladder, if its own efforts do not accomplish this; and secondly, to remove morbid deposits by injecting warm water, and washing out the interior of the viscus. This is often productive of great comfort to the patient; and increased benefit may sometimes be obtained by cautiously impregnating the water so employed with astringent or sedative agents. Of the former kind, one of the best is the acetate of lead, commencing with one-sixth of a grain to the ounce of water; next to this, the nitrate of silver, commencing with one grain to eight ounces of distilled water; or, nitric acid may be used, in the proportion of one or two minims of the strong acid to ten ounces of water. By slow degrees the nitrate may be increased as far as to one grain to the ounce in some obstinate cases, and with much advantage. After washing out the bladder with plain water, at a temperature of about 98° or 100° (a common catheter and gum-bottle, with nozzle and stop-cock, answers every purpose), about two or three ounces of the fluid, which should have the same temperature, should be slowly injected, and, after remaining two or three minutes, be allowed to flow out. One drop of carbolic acid to half a pint of water is a useful injection when the urine is fetid.

If anodyne solutions are indicated in order to allay much pain or great frequency of micturition, the extracts of conium, hyoscyamus, and opium, singly or in combination, may be used. A formula which I frequently employ is the following: Dissolve one drachm of each extract, conium and hyoscyamus, and half a drachm of extract of opium, in two drachms of proof-spirit and fourteen drachms of water; of this solution, add a sixth or a fourth part to three ounces of warm water for an injection, to remain in the bladder five minutes; two-thirds should then be permitted to flow out, and the catheter withdrawn: the rest is retained in the bladder.

All the manipulation connected with these processes must be of the most gentle kind, otherwise more harm will be done by the manual interference, than good by the therapeutical element. And where the plan is manifestly not producing some marked benefit after a few trials, and, *à fortiori*, if it increases the symptoms, the application must be discontinued.

It should be borne in mind, however, that on all occasions of washing out the bladder, a small quantity of liquid only, such as two to three ounces, is to be injected. This may often be highly useful, while the employment of double this quantity may be productive of nothing but mischief. The bladder is usually more or less irritated by throwing in so much as five or six ounces; and it is on this account that I have long ceased to employ injections in lithotomy, save in a few exceptional cases; a plan which is attended with no little benefit.

Counter-irritation is not very manageable in these cases, although sometimes useful. I have employed a Burgundy-pitch plaster, croton-oil in soap-liniment, and strong tincture of iodine, over the pubes, the latter to the perineum also, with some advantage, after shaving the hair. Cantharides, it is said, must be avoided; but I have found no disadvantage from its application to the perineum in the form of the strong acetum lyttæ; and where the inflammation chiefly affects the neck of the bladder, it has sometimes an excellent effect. No better application to the pubes for general purposes exists than a hot linseed-poultice, the surface of which has been sprinkled with mustard.

The pain and loss of sleep often present demand the use of opiates either by mouth or rectum, and generally also such use of aperients as the system demands in consequence. Each case requires often a different treatment; some experiencing more relief from opium by the mouth, others from suppositories or small enemata. Opium alone, or with belladonna, or conium, or hyoscyamus, may be administered often with the best results through the rectum, and with a most tranquillising effect on the bladder.

2. *Internal remedies.* Among the most popular are the infusions of buchu and uva ursi, and the decoction of pareira brava. The indications for their use appear to be the following: chronic mucous discharge from the bladder

in large quantity, associated with relaxation and debility, no inflammation being present, may be controlled by the astringent tonic *uva ursi*; or this agent may be employed with equal parts of decoction of *pareira*. *Chimaphila* is considered by some appropriate in this complaint. The decoction of *senega* I have myself thought superior. In simple irritability of the bladder—that is, when the desire to make water is frequent—in the absence of active inflammation, *uva ursi*, perhaps, affords the best chance of relief. When some inflammation is present (not acute), as evidenced by irritability of the bladder, some little pain above the pubes, and considerable tenderness experienced when a catheter is passed, certain kinds of volatile oil, which are excreted by the kidney and impregnate the urine, are frequently beneficial. One of the mildest, safest, and most easily-digested forms is that found in the infusion of *buchu*, and this is sometimes improved by the addition of a few minims of tincture of *cubebs*, or by a few minims of turpentine or *copaiba*; the latter sometimes exercise a beneficial influence when the *buchu* has failed, more especially in cases where much catarrh is present also.

Dr. Gross employs a combination, sometimes useful in irritable, and even in some inflammatory states of the bladder. One ounce and a half of the leaves of *uva ursi*, and half an ounce of hops, are infused in two pints of boiling water in a covered vessel for two hours; a wineglass to be taken several times a day. Where the cause of cystitis is calculus or stricture, but especially the former, the decoction of *triticum repens*, one ounce of the underground stem, boiled in a pint of water for ten minutes, the whole of the fluid to be taken in twenty-four hours, is often highly serviceable. I have had abundant evidence of its great utility in these, as well indeed as in other forms of the complaint. But it is necessary to bear in mind that most of the vegetable decoctions and infusions should be given in full doses, in order to obtain a good effect; no less than eight or ten ounces daily should be administered, in most cases, of either the *buchu* or the *pareira brava*.

Demulcents are useful by diluting the renal secretion, at the same time that they furnish some little nutriment to the body, and in some instances, perhaps, exert some special therapeutic influence. They are also agreeable vehicles for the administration of acids, alkalies, and other agents, when these are required. Among the most useful are the decoction of marsh mallow, or of the common mallow in its absence; the decoction of carrageen, or Irish moss; the infusion of linseed; the infusion of the bark of slippery elm; the decoction of barley, better known as barley-water; and a solution of gum arabic in water.

The alkalies and the acids are valuable remedies when appropriately given. The old rule of administering the former when the urine is too acid, and the latter whenever it is alkaline, is not to be followed. No doubt, when there is an excess of acid, it may be most effectually diminished and nicely controlled by the alkaline bicarbonate, as well as by the tartrates and citrates; but this is rarely the case in chronic cystitis. It is far less easy to neutralise the alkalinity of urine, the condition most constantly present in catarrh. Some benefit is, however, occasionally to be obtained from small doses of the alkali, even when the urine is alkaline from large admixture of mucous secretions and decomposition of urinary salts in the bladder. If the urine is secreted with its full amount of normal acid, or with excess, it is liable to irritate a vesical mucous membrane whose sensibility is already exalted by inflammation. Hence Dr. O. Rees has proposed to give in such cases enough alkali, such as the citrate of potash, to neutralise the acid reaction of the urine, so that this cause of irritation may be removed; and in some cases a certain benefit is thus attained. Care must be taken, however, not to produce alkalinity of the urine, which it is our object to diminish. The mineral acids have less influence on the reaction of the urine than is generally supposed. Large quantities of nitric or of hydrochloric may be given, without producing any result whatever on the reaction of the urine. The benzoic acid is more certain, and often produces the desired effect when the others have failed. Lemon-juice in full quantity has a similar power in these circumstances.

In almost all instances, the patient should have light and nutritious diet; and sometimes the moderate use of stimulants is called for. It is of great importance to maintain the digestive system in good order, and to avoid obstruction of the abdominal viscera; an occasional dose of blue-pill is sometimes very serviceable to the patient. Rest in the recumbent position, and abstinence from all exertion, especially walking or riding, are in themselves matters of the first importance in treatment.

Suppuration of the bladder is that condition in which the catarrh, already described, consists mainly or entirely of a purulent secretion. It is to be treated chiefly with local mild astringent injections, and has been sufficiently considered with the last subject. The larger the proportion of pus in the fluid of catarrh, the graver is the existing affection.

Abscess of the bladder. Occasionally deposits of pus occur in the walls of the bladder; these are always the result of preëxisting severe disease, usually of a chronic character. Their existence is rarely to be diagnosed or even suspected during life, and no special treatment is indicated.

Ulceration of the bladder. This is by no means a common affection, and seldom occurs except in the last stage of urethro-vesical disease, arising from obstruction when, after long-standing inflammation of the mucous membrane, ulceration takes place. It may result also in advanced tubercular and malignant diseases of the bladder; the ulceration following softening of the tubercular deposit, and disintegration of the cancerous growths. A simple form of ulcer has been observed to occur from permitting a silver catheter to remain with a large portion of the instrument within the cavity of the bladder, upon the mucous membrane of which it has rested or impinged for some days. Signs of ulceration are, blood in the urine, severe pain at a fixed spot, constitutional depression, usually soon ending in death. The urine contains débris of mucous membrane; and if the ulcer increases rapidly, or the tissues become gangrenous, there is much fœtor and dark sanious matter mixed with the excretion. Instrumental explorations are exceedingly painful; there is constant desire to pass water, and the effort produces often severe agony.

Treatment. Stimulants and support for the general condition; full doses of opiates, by mouth and rectum; small doses of alkali internally, and diluents; no unnecessary mechanical interference to be permitted.

Vesico-intestinal fistula. Fistulous openings sometimes form between the bladder and some portion of the intestinal canal. The result is, that some of the liquids from this latter source enter, at first in minute quantity, and give rise usually to much irritability of the

bladder, and other symptoms of subacute cystitis. These are sometimes the earliest signs of the existence of an abnormal communication. If the urine is examined at this early period, fragments of vegetable and of animal fibre may be discovered under the microscope. I have myself been able to diagnose at an early stage, in otherwise doubtful circumstances, the existence of vesico-intestinal fistula by this means. Usually the symptoms become gradually more severe, and the faecal odour and colour are communicated to the urine. At length, considerable fragments of faecal matter enter the viscus, become partially dissolved there, and pass through the urethra. I have seen several cases of this distressing condition, both in the male and in the female, but chiefly in the former; and in these, carcinomatous disease in the abdomen has been the most frequent but not the only cause. For adhesion may take place between an ulcerating bowel and the bladder; and the ulceration may extend into the latter, no cancerous disease being present.

Treatment. Little can be said in relation to this matter. The lesion having been determined, instrumental interference is—except under special necessity, such as for the purpose of removing foreign bodies from the bladder, which are a source of great misery—to be shunned. The use of purgatives is also to be avoided; but the bowels should be maintained, as far as possible, in the natural condition. The food is to be such as will nourish the body without producing a large and coarse residue of faecal matter. In one case under my own care, in which a gentleman passed for several months the whole of the faeces by the urethra, a great amount of suffering was occasioned by swallowing indigestible substances, like grape-stones and husks. Subsequently, by a careful selection of fluid nutriment, the most painful features of the case were much ameliorated. Now and then washing out the bladder with small quantities of tepid water gently thrown in contributed to the patient's comfort. In this case the ulceration was not due to cancer.

Hypertrophy and sacculation of the bladder, dilatation, &c. The muscular walls of the bladder become hypertrophied in most cases of obstruction to the outlet. Increased force being necessary to expel the urine, the organic fibres are augmented in proportion to the action required. Hence the vesical coats may be seen rugose and columnar, resembling in appearance the left ventricle of the heart; and they may reach half an inch, and sometimes even an inch in thickness. From the interlacing of the fibrous bands which constitute the parietes of the bladder, it often happens, when hypertrophy exists, that the mucous membrane is forced by pressure into the interstices between, and that gradually sacculi are formed. These at first are very small, but if the action is continued and powerful, they become large in size, protruding, in the form of tumours, beyond the periphery of the bladder, and forming additional reservoirs for the urine. A sac, or sacculus, may thus sometimes attain the size of a healthy bladder, although the communi-

cation with the original viscus is by a comparatively small orifice. When large, its structure is chiefly mucous membrane and cellular tissue; here and there a few muscular fibres sometimes cross the tumour. Sacculi not unfrequently become receptacles for calculi, and are always so for urine, which is unduly retained by them, and becomes a source of irritation. There is no special sign by which their existence can be certainly diagnosed, although it may be suspected; neither is any specific treatment requisite beyond that necessary to all those cases in which the bladder fails to expel its contents, and is the subject of chronic inflammation.

In addition to hypertrophy, the walls of the bladder are sometimes thickened by a deposit of lymph from inflammation; a circumstance which impairs, and almost destroys, the muscular action of the viscus. Very frequently the bladder is simply dilated, and even distended, as a result of obstruction, the walls being thinner instead of thicker than natural. This condition occurs, not in stricture, but in those cases of enlarged prostate where, by reason of the size of the prostatic mass implicating the muscular apparatus at the neck of the bladder, the viscus is incapacitated from contracting, and suffers passive distension. Hypertrophy does not then take place because muscular action is impossible, or nearly so.

Vesical hæmaturia (see *Hæmaturia*, p. 335).

Tumours of the bladder. These affections may be classified as follows:

1. Fibrous growths, of a warty and of a polypoid character.
2. Villous or vascular growths.
3. Malignant growths.

1. *Fibrous growths* are rarely met with, but the few specimens preserved in our museums indicate the classification presented here. They are non-malignant in character, causing injury and almost always death solely by the obstruction they occasion to the urinary outlet. They are connected with the mucous membrane and sub-mucous tissue, and are made up of elements normally belonging to the latter. They appear to commence in the form of simple circumscribed elevation of the mucous membrane, resembling a warty growth; and, subsequently, they enlarge, protrude, and assume a polypoid form. A single anatomical preparation may afford examples of all stages of development between the earliest elevation and the fully formed polypoid tumour. There is no analogy whatever in origin or structure between them and the uterine growths; nor between them and the polypoid outgrowth, which is frequently found springing from the posterior part of the prostate.

The *symptoms* are those common to all forms of obstruction to micturition, added to the special signs of foreign body in the bladder. Careful sounding may detect their position and form, and will prove the absence of stone. The complaint is most frequent in children and young people. Unlike the villous and the malignant growths, they rarely give rise to blood in the urine.

Treatment. No special curative treatment is applicable in the male subject of these growths; much may be done to palliate the symptoms and to support the powers of life, by adopting those means which are fully detailed in considering the effects of obstruction under the heads Stricture, Enlarged Prostate, and Chronic Cystitis. In the female, a growth of this kind has been removed by ligature, the urethra easily admitting the requisite degree of dilatation.

2. *Villous growths.* These have usually been classified as “malignant,” but have no claim, either by their structure, their action, or by the presence of constitutional cachexia, to be so considered. The villous growth of the bladder is a soft, flocculent body, about the size of a large marble when fully developed, made up of innumerable villous processes, floating in water and branching off in every direction from the base, which is connected solely with the mucous and submucous tissues. These villi are identical in structure with the villous processes of the chorion in its normal state, and are very vascular. Several such tumours may coexist in one bladder; and the whole or a large portion of the mucous lining of the organ may, if closely examined, be found more or less studded with small villous processes, similar to those of the tumour itself.

The *symptoms* have nothing special to distinguish them from those of other tumours, excepting the frequent or almost constant appearance of some blood in the urine without provocation. Indeed, death occurs rather from hæmorrhage than from obstruction in these cases, as well as in part from the exhaustion which the severe pain, which is always present, induces. Small shreds are frequently found in the urine, which, under the microscope, sometimes present appearances indicating the nature of the disease. The growths are too soft to be identified by the sound, and instrumental interference almost always greatly aggravates the symptoms.

Treatment. The indications are, to allay pain, to subdue spasmodic action of the bladder, to prevent hæmorrhage by internal remedies, and to counteract its effects on the system by chalybeates and nutritious diet. Astringent injections very carefully introduced into the bladder, such as weak solutions of acetate of lead or of nitrate of silver, may be tried; they are, however, not to be repeated more than once or twice, unless marked benefit is observed, and signs of vesical irritation have not been produced by their employment.

3. *Malignant disease of the bladder* is more frequent than the

growth just described. Sometimes it is primary, commencing independently in the bladder; at other times it is secondary, extending from the prostate, from the uterus, or from the rectum. The species may be scirrhus, but is usually encephaloid when originating in the bladder; always the latter when spreading from the prostate; when from the rectum, it is commonly scirrhus; from the uterus, the same, or epithelioma. Colloid is said to have existed, although it must be extremely rare. The disease generally runs a rapid course, and presents the constitutional characters significant of malignant action. In cases of encephaloid a large mass is soon formed, which sometimes almost fills the cavity of the bladder.

Symptoms. One of the most strongly-marked signs of this affection is hæmorrhage into the bladder, generally occurring suddenly and in large quantities, rather than by frequent or continuous oozings from capillary vessels, which latter mode is more characteristic of villous growths. The pain is also very severe and lancinating, and is referred as much to the loins, back, and thighs as to the pubic and perineal regions. All the signs of obstructive disease and chronic cystitis are present. Constitutional cachexia accompanies the local disease in its advanced stage; glandular enlargements are usually distinguishable in the iliac regions; and the patient suffers from loss of blood and rest. Small portions of disintegrated tissue and bloody sanies are often voided from the bladder; occasionally cells may be found in the urine, which, when examined by the microscope, seem to indicate the specific character of the disease; but the diagnosis is generally tolerably clear without the somewhat questionable support which is to be derived from this source. Without in any respect undervaluing the utility of microscopic examination, I am compelled unhesitatingly to conclude, after long experience of its application to these cases, that not much stress must be laid on the indications which cell-growths in the urine afford in respect of the presence of malignant or non-malignant disease in the urinary passages.

The principles of *treatment* vary in no respect from those which have been laid down under the head of villous tumours. Opium in some form, administered both by mouth and by rectum, and occasionally by injection into the bladder, is of great value in alleviating the severe suffering; and must usually be given towards the later stages of the complaint with great freedom. In all those complaints of the urinary organs where little or nothing remains to be done but to alleviate pain and support the powers of life, the remedies necessary should be given with no sparing hand. So severe is the anguish which the patient suffers if left to the action of his complaint, unchecked or only partially checked by anodynes and anæsthetics, that it must be regarded as cruel to deprive him of their aid in mitigating his distress, so far as they can be made available without danger to life; while at the same time alco-

holic stimulants are in some cases less valuable than opium in enabling him to endure the progress of his malady.

Tubercle of the bladder. One of the rarest of the affections of the bladder is tubercular deposit; probably it never occurs unassociated with tubercular disease in other parts of the body; indeed in almost all—perhaps it may be said in all—cases, other parts of the urinary system are similarly affected, and these are generally the kidneys and prostate. In women it has been found to have followed primary disease in the uterus. The disease commences by a deposit in the coats of the bladder of small tubercles: these become numerous and coalesce; subsequently the morbid material softens, the mucous membrane gives way, disintegration takes place, and a ragged ulcer ensues; a large extent of the inner coat being sometimes destroyed before death.

The symptoms of this disease are not peculiar; and the diagnosis depends rather on negative than positive signs. The absence of much or frequent hæmorrhage may serve to distinguish it from malignant and villous tumours. Great pain and extreme irritability, frequency in making water, the absence of calculus or other foreign body in the bladder, as ascertained by sounding, together with the presence of tubercle elsewhere, and progressive emaciation, and lastly the patient's age, usually early or middle adult life, will serve to indicate the true character of the disease.

Treatment. That which is adapted for constitutional tuberculosis in relation to the general health. For the local complaint, anodynes, the remedies for chronic cystitis, rest; and no mechanical interference when the diagnosis is tolerably clear.

Bar at the neck of the bladder. The enlargement of the prostate, common in old age, often produces an elevation of the structures, sometimes amounting to a distinct ridge, which exist at the inferior aspect of the neck of the bladder. A bar may be thus said to be formed there; nevertheless, it has not been usual in this country to apply that term to any product of the enlarged prostate; it has been thought more desirable to reserve it rather to denote any bar which may exist in the spot described, but which is not prostatic in its character. Such bars occasionally exist, and usually in elderly subjects. Mr. Guthrie was the first to point out this fact. He believed the bar to consist in disease of "the elastic structure," existing at the neck of the bladder, and as such to be quite distinct from the very common complaint already referred to. After considerable study of this question, I cannot but consider the non-prostatic bar as extremely rare, since almost all permanent obstruc-

tions at the vesical neck are due to enlargement of the gland or to its effects; nevertheless, in very exceptional instances the bar in question is undoubtedly to be met with.

In all long-continued diseases of the urethra and bladder it is common to find a hypertrophied condition of the uvula and associated muscular fibres, and more or less elevation at the neck of the bladder, or bar, as its consequence; but this is not to be regarded as an example of the disease in question.

The treatment mainly consists in combating the symptoms of chronic cystitis which may arise, and occasionally passing a large catheter, so as to insure a patent condition of the neck of the bladder. Mr. Guthrie and others have proposed to divide the bar by incisions; but the rarity of any true barrier here, apart from prostatic enlargement, will induce extreme caution in affirming positively the presence of this affection during life; and any severe surgical operation for its relief could only be contemplated in presence of very serious symptoms as its undoubted effect. The subject of operations for relief of obstruction at the neck of the bladder is considered at the close of the section devoted to treatment of the enlarged prostate of age.

Hernia of the bladder is a rare affection, liable to occur in both sexes: in the male, as inguinal; in the female, usually as vaginal hernia, although it may be femoral. In the former it generally forms part of a large mass occupying the scrotum, pressure on which sometimes evacuates the portion of urine which is liable to be retained in that situation, the bladder occupying in part the pelvis, and in part the scrotum. It may be associated with a hernial protrusion of bowel, or may exist independently of this. In the former condition it has been met with in the operation for strangulated inguinal hernia, and has even been opened by mistake, as in one of the two cases recorded by Pott. The portion of bladder forming the hernia always escapes from beneath the peritoneum, and consequently is never found covered by that structure. In cases which are detected early, a truss may be successful in retaining the viscus within the pelvis; where permanent adhesions in the anomalous position have taken place, mechanical support is to be applied to prevent further protrusion.

Inversion of the bladder. This is an exceedingly rare affection, and is found exclusively among female children. Three cases only have come to my knowledge;* their ages when first seen were from two to four years, although the condition probably commenced at a very early age. The bladder is gradually prolapsed and protruded through the urethra, which becomes much distended, until the viscus presents the appearance of a pyriform, red, and vascular tumour.

* *Lond. Med. Gaz.* 1833, Jan. 19; *Trans. Prov. Med. and Surg. Assoc.* 1846, by Mr. Crosse, with plate; *Lancet*, 1862, vol. i. p. 250, by John Lowe, M.D.

One of these cases narrowly escaped the application of a ligature, on the supposition referred to; but on careful examination the orifices of the ureters were discovered, and reduction was accomplished by manual pressure. Considerable incontinence existed subsequently in the two former; but in the third it occurred to the Surgeon (Dr. Lowe, of Lynn) to apply a heated iron to the urethra (in all five times), and to maintain a silver catheter with a bulbous extremity in the bladder, between two and three weeks; by which means the viscus was maintained in its place, and cicatrisation of the dilated canal ensued. The bladder was enabled subsequently to retain some ounces of urine, and slight incontinence only remained.

2. Conditions which do not necessarily involve organic structural changes, appreciable by known methods of observation, and which are generally associated with some injury or derangement of a nervous centre.

Paralysis of the bladder. One of the most common terms used in relation to complaints of the bladder is paralysis. Yet true paralysis of the bladder, some lesion of a nervous centre being absent, is one of the most uncommon affections. Indeed the word is loosely, not to say incorrectly, employed. For example: the bladder when unable to evacuate its contents from obstruction by stricture, or by prostatic enlargement, or by atony from over-distension, is commonly said to be "paralysed," although there is no derangement of the nervous supply; to which condition the use of that term ought, in accordance with our employment of it elsewhere, to be limited. The bladder may possess its normal contractile power, but be unable to overcome an abnormal obstacle in the outlet, and so fail to expel its contents; the complaint in this case is not paralysis of the bladder, but solely obstruction in the channel of exit—two totally different conditions. This distinction must be clearly kept in view in our consideration of this subject.

True paralysis of the bladder is a condition in which the contractile power of its muscular fibres is lost or impaired from failure of nervous supply; thus there may be partial as well as total paralysis. The usual cause of this accident is cerebral or spinal lesion. It happens in some injuries to the brain, in almost all serious injuries of the spine, in softening, in apoplexy, and in all serious organic affections involving those parts of the cerebro-spinal system which affect the urinary apparatus. It occurs from spinal debility produced by excesses, especially of a sexual kind; also in temporary functional derangement of the nervous centres; through the agency

of reflex action from some adjacent source of irritation, as in hæmorrhoids, and especially after operations for their removal; and after other operations; although in some of these cases the retention is probably due rather to spasm of the constrictor muscles than to paralysis of the bladder. It may also happen after shock to the system from any source, in fevers, &c.

I have met with a single case of permanent paralysis of the bladder attributed to an overdose of belladonna. Certain it is that the effect of hyoscyamus and belladonna is frequently to produce temporary paralysis; and in this manner they combat undue irritability of the organ, for which they are so constantly prescribed. It is extremely rare, however, to meet with an example of true limited or local paralysis (the temporary conditions just referred to only excepted) of the bladder, either affecting the body of the organ alone, producing retention; or of its neck alone, producing incontinence; or of the entire organ, the result of which is also retention; which latter is observed in cases of spinal injury. Notwithstanding that such conditions have been elaborately described, and regarded as common occurrences, the true pathological lesion is in almost all cases atony from over-distension, and not paralysis (see next section).

Treatment of paralysis. From whatever cause, the first duty is to empty the bladder, by means of the catheter, twice or thrice daily. It should be employed with great care; for the patient has probably lost sensibility, and cannot indicate, by complaining of pain, when injury is inflicted; while the urethra is often in a lax state, and consequently a slight laceration is easily made. A full-sized instrument, either gum or silver, whichever is found to pass most easily, must be employed. If signs of chronic cystitis manifest themselves, the appropriate remedies must be employed, especially the local ones, among which washing out the bladder, followed by very mild astringent injections, may be reckoned as the best.

In cases not traumatic, or depending upon acute disease, strychnia, steel, cantharides, ergot of rye, and arsenic, deserve a trial. Galvanism, cold douches, and blistering, should also be employed as local agents.

Atony from over-distension. Organic obstruction having existed either at the neck of the bladder (enlarged prostate), or in the course of the urethra (stricture), during a considerable period, and having gradually augmented in amount, the contractile power of the bladder becomes insufficient to expel all the urine, and a portion is left behind at every act of micturition. This goes on increasing until, in some cases, the amount so remaining, technically called "residual urine," reaches twenty or even thirty ounces; it then begins to open out the neck of the bladder, and some of it runs off during sleep, or when strong muscular efforts are made. The fibres of the bladder being unequal to the task of expelling the urine through

the narrowed channel, and, not having been permitted to resume the natural condition of complete contraction, are over-stretched, lose their tone, and, even on the obstruction being removed, cannot expel the contents of the viscus. A similar state may be produced when no organic obstruction is present, from long-continued retention of urine exerted voluntarily, or occasioned by temporary spasm, or by some cerebral affection, in fevers and the like. The patient whose bladder has been thus over-distended, often finds himself unable to empty it subsequently. Such is the condition termed here atony, and often falsely called paralysis, which affection has been already considered in the preceding section.

Treatment. It is essential, in the first instance, to insure the complete emptying of the bladder for a time, at least once or twice daily. The muscular fibres must be enabled to resume their normal condition of contraction from time to time; and this never can take place unless the bladder is artificially emptied. Sometimes, if the over-distension has not continued too long, they gradually regain their tone, or at least recover much of it. When the abnormal state has existed long, it may be often greatly benefited, but is rarely completely removed. Without the mechanical aid all medical treatment is absolutely useless, but it may perhaps be useful in combination with the former. The general and local stimulants of nervous action, already advised in paralysis, should be employed in this affection also. The cold douche over the lumbar spine and on the abdomen is sometimes particularly useful. Injections of cold water into the bladder itself are the best of all direct applications to the viscus.

Irritable bladder. This term is often very loosely employed to designate some specific affections of the bladder. Like the term "dropsy," "irritability of the bladder" denotes nothing more than a symptom; in either case the real cause must be discovered; the terms themselves conveying no meaning beyond the simple fact, in the former case that a collection of water is present, in the latter that the patient passes urine too frequently. Irritability of the bladder is a symptom present in almost every affection of the urinary organs, from childhood to old age; and it is named here at the head of a section solely on account of the conventional misappropriation of the term, and as affording an opportunity of protesting against it. Nothing is more common, even in professional communications, than to be asked what is the best remedy for "irritability of bladder." It denotes no special pathological state, and always requires to be considered in connexion with the other symptoms which are allied with it, before a diagnosis of the existing complaint can be made.

Spasm of the bladder denotes another symptom, but this term is less frequently misapplied. It implies that the contractions of the bladder are involuntary, uncontrollable, and exceedingly pain-

ful, the cause usually being inflammation, stone, foreign growths, &c. As in the preceding instance of "irritable bladder," it is often employed to denote a specific affection when the true disease has not been discovered; but the existence of some exciting cause may be predicated as invariable. Spasm is allayed, whatever the cause may be, by general and local anodynes, anæsthetics, and antispasmodics, as described under the head of treatment for cystitis, prostatitis, and stricture, with which conditions it is liable to coexist.

Perverted sensibility of the neck of the bladder, or neuralgia. There are a few cases of severe urinary symptoms met with in which neither researches during life, nor inspection after death, have revealed the nature of the affection. It is important to remark that the number of instances admitted to this category in practice, diminishes in direct proportion to the degree of skill in diagnosis which is brought to bear on obscure cases. Usually the patient complains of symptoms greatly resembling those of stone, but repeated soundings fail to detect a stone, or any other deviation from the normal state of the organs. The urine is healthy, or at most only occasionally contains traces of undue action of the mucous membrane. Errors in diet sometimes aggravate the symptoms, sometimes have no effect. Change of air and scene often produce an improvement, which unhappily is only temporary. By careful investigation, a deranged state of the liver, early stages of renal disease, the presence of hæmorrhoids, commencing cerebral changes late in life, or miasmata, may be found to account for some cases; but nevertheless a few remain apparently inexplicable. Such are usually regarded, for want of a better, or more certain knowledge, as examples of "neuralgia" of the neck of the bladder. The treatment ordinarily directed to improvement of the general health, and against periodicity of attack, if such be present, is generally indicated in such cases. Palliation of severe pain is to be obtained by the usual remedies.

Incontinence of urine. An involuntary flow of urine from the bladder may occur under two widely different conditions: the first, during sleep only, in young subjects, the bladder emptying itself when the control of the will is suspended; the second occurs in adult subjects of all ages, when the bladder is already over-distended with urine, a certain quantity, which usually bears a very small proportion to the quantity retained, running off either during sleeping or waking. The following rule almost invariably holds good: in juvenile incontinence there is no retention of urine; in adult incontinence it is present to a serious extent. There is no principle more

important to remember in the treatment of diseases of the urinary organs than this, viz. that an *involuntary flow of urine in the adult indicates a distended, not an empty bladder.*

1. *Incontinence in childhood and youth.* This is a common and sometimes a very troublesome infirmity, affecting patients generally under the age of puberty, although occasionally it continues during some years after that period. The single symptom is that, in the middle of the night or towards early morning, the child wets the bed without awaking, and the act may be repeated once or a greater number of times before rising. Sometimes this occurs every night; sometimes there is an interval of one night, rarely of more. The patients so affected do not appear to belong to any particular temperament, nor to be necessarily weak and cachectic. In some the failing is simply a habit resulting from want of management, such as neglecting to take up young children once during the long period which is necessary to them as a night's rest. In such cases careful attention to habits and diet may arrest the infirmity. In many cases, however, no ordinary management succeeds, and medical aid is sought.

Innumerable remedies have been given, and with a very unequal success. Small doses of cantharides and of strychnia, either with or without iron, are sometimes employed. Tincture of iron alone, or the *vinum ferri*, has sometimes proved successful. Blisters to the sacrum has been a favourite remedy; also cold douches to the spine, and general tonic treatment in most cases. In my own experience, nothing has afforded such good results as belladonna. I have employed it in the form of extract, commencing, according to the age of the patient, with the sixteenth to the eighth of a grain twice a day, and increasing the dose if required as far as it can be safely borne. It is necessary to add, that disappointment has arisen in the use of this remedy from the impurity of the drug; it is absolutely necessary to employ a pure extract. After failure with a preparation from one source, I have quickly succeeded with one obtained from another.

In cases of extreme obstinacy, I have succeeded by applying a solution of nitrate of silver, ten grains to the ounce, to the prostatic portions of the urethra and neck of the bladder. This remedy is also easily applicable to the posterior part of the urethra in the female.

In no cases is it desirable to employ mechanical pressure to prevent micturition. Either by some of the agents already named, or by the improvement of the health, in which may be included the removal of worms, and other sources of intestinal irritation always to be looked for in obstinate cases, success may generally be attained sooner or later, although perseverance is occasionally necessary for a long period of time.

2. *Incontinence in the adult*, as has been before shown, indicates, in the vast majority of cases, a bladder distended by retained urine; the cause of which may be stricture, enlarged prostate, cystitis, stone, atony from over-distension, or true paralysis. Very rarely does it happen in the male that the urine runs off from the bladder as fast as it arrives there from the kidneys. Hence it is a cardinal principle in practice, that whenever urine runs off incontinently, a

catheter should be passed to ascertain the amount of retention present, and to relieve it. In the female, true incontinence is more frequent, and is generally caused by a traumatic injury to the short urethra, which has impaired or destroyed the sphincter's action, such as sloughing from pressure in labour, or from the use of instruments to remove the child, from over-distension of the urethra in removing calculus, &c.

In regard to the treatment of incontinence, it is unnecessary to recapitulate that which is appropriate to the various conditions above mentioned as causes of an unnatural flow of urine from the bladder, since they have been considered under their various headings. When that rare affection in the male adult, true incontinence, maintaining the bladder in a constantly empty state, is really present, the cause will be sought either in some perverted action of the nervous centres, or in a certain rare form of prostatic enlargement in which the phenomenon in question does occur. Supposing that there is no local organic disease to be found in the urinary organs, the nervous centres alone can be held responsible for the symptom; a strict investigation of the cerebro-spinal system must be instituted, and some other sign of lesion of that system will probably be discovered, in which case the treatment must consist in that which the general affection indicates, together with the employment of some local appliances suited to protect the patient from the disagreeable results of his infirmity, such as a well-adapted urinal. Where incontinence results, as occasionally happens, from mere functional derangement, caused by debility from excesses, the cure will be effected by any means of a tonic character which can restore normal tone to the spinal system. For this object the preparations of steel and zinc, of strychnia, together with quinine and other vegetable bitters, are of great value. Nutritious diet, cold sea-bathing, and abstinence from the causes of debility previously acting, form also a part of the treatment for these cases. The local alteration of structure, which does occasionally give rise to the incontinence just described, is a form of enlargement of the prostate, in which the posterior portion, commonly called "third lobe," is much hypertrophied, and projects forward in the manner of a wedge between the two lateral lobes, so as to open out the neck of the bladder and render it constantly patent; instead of projectly backwards into the cavity, as almost invariably happens, and forming a species of valve which prevents the outward flow of urine. The former condition permits the bladder to remain constantly empty, and the organ becomes small in capacity. The latter maintains it constantly filled with stagnant urine, unless the catheter be employed to remove it, and produces a dilated and capacious bladder. The treatment of the former condition consists mainly in providing a urinal; nothing in that stage can be done to modify the form or condition of the enlarged prostate, beyond that which is effected in preserving as good a state of the general health as circumstances admit.

Habitual engorgement of bladder, and overflow of urine. These terms more correctly describe the conditions met with in the majority of cases in which urine passes involuntarily, than that of "paralysis," so commonly used, and already referred to at length. Urethral obstruction from enlarged prostate, or stricture, having existed for a certain period of time, the bladder becomes unable to contract with sufficient force or continuance to overcome the obstacle and empty itself; so that a certain portion of the urine always remains after every act of micturition. This failure of the bladder to con-

tract fully, when once established, becomes gradually more marked; the remaining quantity of urine becomes larger; the viscus is habitually engorged with fluid, its coats are thinned, distended, and atonied, its neck is dilated, and as this permits a portion to run off irrespective of the patient's will, brief temporary relief is afforded. This overflow occurs first during sleep, and subsequently from pressure of the abdominal muscles when any efforts inducing their contraction are made. Unless this state of things is remedied by proper treatment, the result is, sooner or later, chronic inflammation of the bladder, with a tendency to spread upwards to the ureters and kidneys.

The treatment of engorgement and overflow consists in emptying the bladder from once to three or four times in the twenty-four hours, according to the necessities of the case, and in using those remedies which the amount of chronic cystitis, almost always present to some extent, indicates to be necessary (see Chronic Cystitis, p. 345).

Retention of urine (see Stricture).

THE PROSTATE.

Malformations. There are no special malformations to be noted here, except such as are involved in the condition called "extroversion of the bladder," which see (p. 339).

Injuries (see vol. ii. p. 498).

Inflammation of the prostate	} acute, chronic.
(prostatitis),	

Abscess of the prostate.

„ periprostatic.

Hypertrophy and simple tumours.

Atrophy.

Malignant disease.

Tubercle.

Cysts.

Acute inflammation of the prostate. This affection rarely exists alone, but is generally associated with inflammation either of the urethra or of the bladder. It may be secondary to cystitis, and often is so; but it more frequently owes its origin to gonorrhœal inflammation, which has extended unchecked to the prostate, and it may be to the bladder also. Sometimes, however, it happens apparently as a purely idiopathic occurrence, and not by extension through continuity of tissue. This idiopathic inflammation, excepting the cases produced by violence, as by instruments, &c., is probably extremely rare.

Causes. These are: the præexistence of acute inflammation of the urethra from any cause, but especially the gonorrhœal; stricture of the urethra in an aggravated form, giving rise to inflammation of all the parts posterior to it; the application to the prostate of strong injections, cauterisation, the passing of sounds, and mechanical violence of various kinds; inflammation of the bladder, and calculi. Cold and damp to the perineum will give rise to it, perhaps most frequently in gouty and rheumatic subjects. Alcoholic drinks may induce prostatic inflammation, urethritis already existing, but only on this condition. Inordinate sexual excitement, under the last-named circumstances, is also an undoubted cause.

Symptoms. At first, a sensation of weight and fulness about the rectum and perineum is experienced, with some pain and uneasiness at the neck of the bladder. The patient wants to pass water more frequently, and does so with much pain, especially at the close of the act. These symptoms increase; the pain becomes severe, shooting and throbbing, and almost continuous; a sense of great tension is experienced, and the anus and perineum are tender when pressed. Pain in the back and loins, and often in the thighs, is complained of. Movements of the body become painful, as does also the sitting position. The act of relieving the bowels at stool produces considerable distress; and a finger introduced into the rectum encounters opposition; the anterior wall of the bowel is prominent, hard, and hot, and the outline of the prostate may be traced, much larger than in the natural state. An attack of piles may be induced, the close contiguity of the hæmorrhoidal and prostatic veins favouring this result. Should a catheter be passed, the patient complains of excessive pain when the instrument reaches the prostatic part of the urethra. At a later stage, if suppuration has taken place, the rectal swelling becomes softer. Micturition is often difficult, and may even be impossible, total retention occurring from the obstruction produced by the swollen prostate. General fever accompanies these symptoms, commencing with rigors, and manifesting itself by all the usual signs during the acute stage of the disease. Pus usually appears in the urine after a few days, and if there has been abscess, often in large quantity.

Treatment. In general cases antiphlogistic regimen and diet should be observed. There is seldom reason to bleed from the arm, none to give mercury, except as a purge; but a little antimony and full doses of alkali should be taken, such as the bicarbonate or acetate of potash. The bowels should be freely opened at the outset, and a gentle action upon them maintained afterwards. Local bleeding usually gives more relief at the outset than anything else. From ten to twenty leeches should be applied to the perineum and around the anus: or a cupping to six or eight ounces may be performed.

Then a hot hip-bath should be taken, followed by a large poultice on the perineum, and the patient be wrapped up warmly in bed. The hip-bath may be repeated with advantage in the course of the treatment, but should not be used for more than ten minutes at a time as a rule. If retention of urine occurs, and does not give way at once to hot fomentations and a full dose of opium, a medium-sized gum elastic catheter should be passed, and the bladder relieved. The instrument may generally be withdrawn at once, and is to be used again if necessary (see Retention of Urine).

In the course of a few days the severe symptoms generally subside, often, however, not without the occurrence of occasional relapses. These are mostly attributable to some indulgence on the part of the patient, either in the use of stimulants, exercise, or erotic excitement. When convalescence is established, the prostate still remains much enlarged and hard, and the stream of urine is not propelled with the natural amount of force.

Chronic inflammation. Sometimes the prostate is enlarged, but not invariably; when occurring as a sequel to the acute attack, perhaps it always is so. The symptoms are: diminished force in propelling the urine; usually also some gleety discharge; the urine is cloudy, and deposits more or less pus on standing, and after passing it, a drop or two of blood may follow. There are weight and dull pain in the perineum and about the anus; pain also in passing water and in sexual intercourse; and sometimes frequent and debilitating nocturnal emissions. The bladder is irritable, and all the symptoms are generally aggravated by much exercise and by errors in diet.

Treatment. One of the best means is continuous counter-irritation of the perineum by nitrate of silver or acetum lyttæ, maintained for some weeks, and the surface dressed with simple ointment. Tonics and good diet, with attention to the digestive organs, are almost always indicated; these latter being in fair condition, iron is mostly beneficial; and as the bowels should in these cases not be constipated, the iron should be combined, when necessary, with some mild laxative. When nocturnal emissions are frequent, and especially if they occur without any consciousness whatever on the part of the patient, the application of a solution of nitrate of silver, from ten to thirty grains to the ounce, to the prostatic part of the urethra, is one of the best means of treatment. To be successful, an efficient instrument is absolutely necessary, as well as care in injecting the fluid at the right spot: three or four applications may be requisite. Let it be remarked, that we are by no means to infer the existence of chronic prostatitis because the patient is subject to frequent seminal emissions. These occur frequently from altogether different causes, which, as they have no necessary connexion with disease of the prostate, need not be further considered here.

When enlargement only remains after acute inflammation, the iodide and the bromide of potassium should be given for a considerable period of time, Conjoined with or following this treatment, a course of tonics, steel and quinine, with sea-bathing and generous diet, often effects a great improvement and completes the cure.

Abscess of prostate. Acute inflammation, when neglected, or occurring in a naturally weak or delicate constitution, may result in suppuration of the organ. This occurrence may be suspected when after the first week or two the acute symptoms do not subside, when the pain and difficulty of micturition and defæcation increase, if rigors occur, and the patient is very restless and feverish, complain-

ing of tension and pulsation in the perineum or neck of the bladder. Fluctuation may be felt per rectum; or pressure in the perineum may reveal tenderness and fulness there. The natural course of abscess in the substance of the prostate is generally evacuation by the urethra. Occasionally it issues by the rectum, and this is perhaps as favourable, generally speaking, as through the urethra. It may be followed by a troublesome urethro-rectal fistula; but this is rare. Generally the opening of the prostatic abscess into the urethra soon closes; but if this does not take place, the cavity may long remain open, and become a receptacle for urine, giving rise to fresh abscesses in the vicinity.

In treating a case presenting the symptoms described, we should watch for any evidence which may exist of matter forming in the perineum; and if so, an incision should be at once made boldly in the median line, so as to evacuate it. If successful, the patient will be greatly benefited; but if no pus is encountered, no harm results, but the relief of pain and of tension is probably effected. Occasionally puncture of the abscess has been accomplished in the rectum when fluctuation has been distinctly felt there.

The discharge of matter from an acute abscess of the prostate is sometimes followed by long-continued suppuration. Chronic abscess may arise here spontaneously, though not very frequently; generally resulting from confirmed or neglected stricture of the urethra. When this has occurred, and the matter has been discharged into the urethra, it sometimes happens that the cavity enlarges, urine makes its way into it, fresh irritation is maintained, and much of the prostate is destroyed; its capsule becoming little more than the sac of a pus-secreting cavity. Sometimes the abscess is limited to one side or lobe only, and sometimes the collections are two or three in number; generally speaking, however, the result found after death is that described. This condition is always one of serious import, and its existence is often not suspected during life. There are present the symptoms of chronic cystitis, emaciation, often hectic; and a highly tonic and soothing regimen is usually indicated. Injections of nitrate of silver, of half or one grain to the ounce, are sometimes useful; but no local interference is desirable which gives much pain, or even temporarily aggravates the symptoms.

Abscesses supposed to be prostatic have not unfrequently turned out to be situated external to the prostate, and not within the envelope of the organ. Such are termed periprostatic. They arise much in the same manner as prostatic abscesses, but are of less serious import than those situated within the capsule of the prostate itself. The treatment requires early incision, and does not differ in other particulars from that already described for prostatic abscess, properly so called.

The organic enlargement of the prostate of advanced age (hypertrophy). This common affection very seldom occurs before sixty years of age; I have never seen or heard of a true example of it before the age of fifty-four years. Chronic inflammatory enlargements may occur at any age after puberty; but the disease now under consideration is wholly distinct, both in nature and by causal relations, from such or any other inflammatory state. It has been said to be the common inheritance of old age, but it is, on the contrary, a complaint which a very large majority of elderly men escape. With the view of ascertaining the relative frequency of its occurrence, so far as such a number of observations can be regarded as indicating it, I dissected out with great care the prostate in forty-three elderly individuals, the results of which inquiry are presented in the following summary: Appreciable enlargement existed at the rate of 32 per cent; notable enlargement, causing symptoms during life, at the rate of 12 per cent. The oldest individuals of the series were among the unaffected; including 1 at ninety, 1 at eighty-five, and 2 at seventy-nine years. Subsequent more extended researches by Dr. Messer and myself have but confirmed these results.

The enlargement consists mainly of an over-development of certain tissues which enter into the normal structure of the organ itself. These tissues consist, first, of unstriped muscular fibre and the connective tissue always associated; and they form at least three-fourths of the prostatic body: secondly, interspersed among this structure are numerous branching glandular tubes and crypts with their accompanying ducts.

Enlargement, or hypertrophy as it is commonly termed, may be determined by an abnormal production of the first-named elements alone, or with some of the glandular tissue interspersed; and this latter may be fully or imperfectly developed. The two lateral lobes of the prostate may in this manner be increased to four or six times their natural weight and bulk; or an outgrowth may take place from the central part of the organ, in a backward direction, towards the cavity of the bladder, as a more or less rounded or pyriform tumour of prostatic tissue, and constituting what is frequently, but not very correctly, called the enlarged "third lobe;" and this form is one of those most commonly met with. Generally, however, every part of the organ partakes more or less in the enlargement.

Again, while the tissues thus described may be generally over-developed throughout the entire prostate, it is very common to find independent, or almost independent, and isolated tumours of the same material embedded within the prostatic structure proper. On

making a section with a sharp knife of a prostate so affected, these small rounded bodies are easily divided, and the portions may be removed by the finger-nail. They are usually made up of very compact tissue, like that of the prostate itself, but generally with less of the glandular element, and that, almost always, presenting a defective development. Sometimes they are completely isolated by a limiting fibrous cyst. The presence of these small tumours is extremely common in the enlarged prostate, as well as in the healthy organ in advanced life, and they seem to bear a relation to the containing organ somewhat similar to that which the uterine fibrous tumours bear to the uterus. In both cases they are composed mainly of unstriped muscular tissue, and exhibit other points of analogy in their nature and history.

The most important result of enlargement is obstruction to the flow of urine. Its first effect on the prostatic urethra is increase, sometimes considerable, of its antero-posterior diameter; there is also diminution of its lateral or transverse diameter, the canal becoming a narrow passage, instead of one which, when distended, is of about equal diameter in every direction. The length of the prostatic urethra is also materially increased, and it is often tortuous also. In some preparations which I have examined, the urethra has measured four inches from the orifice of the bladder to the membranous portion, instead of one inch and a half, which is the normal length.

The natural direction also deviates: where there is enlargement of the median portion or "third lobe," the urethra suddenly rises, producing an angular curvature in the place of a nearly straight line; so that a complete step has sometimes to be surmounted at the neck of the bladder before an instrument will enter the cavity. When, with this development of the median portion, there is much enlargement of either lateral lobe, the lateral direction of the canal is also changed. Thus if the right lobe predominates, there will be a lateral curve of the urethra, the convexity of which is presented to the left, and *vice versâ*.

The next deviations are those in the form of the internal meatus, or vesico-urethral orifice. When the median portion predominates, this orifice has a crescentic form, the convexity of which is directed upwards. When the right lobe considerably exceeds in size the left, the crescent has its convexity to the left side; and so on. In some preparations, where two or more irregularly-enlarged lobes are combined, the orifice is much distorted, presenting a tortuous outline. Sometimes it is overlapped by an outgrowth from the median portion in the form of a valve. In this case, which is not common, the

valvular portion appears to be forced against the neck of the bladder by the effort of micturition, and the obstruction rendered still more complete.

The size and weight attained by hypertrophied prostates are sometimes remarkable. A prostate measuring two inches in a transverse direction, and one inch in thickness from before backwards, or which weighs an ounce, must be considered hypertrophied. On the other hand, a transverse measurement of three inches is not uncommon. I have seen one exceeding four inches and a quarter; but such a degree of enlargement is extremely rare. The weight has been known to reach twelve ounces. In malignant disease even these limits are exceeded.

The consistence of the organ varies, being sometimes firmer and harder in texture, at others a little looser and softer than in the natural condition. It usually presents the former character when numerous fibrous tumours are embedded in its substance.

Symptoms. In the earliest stage of chronic enlargement of the prostate there is nothing to attract the attention of the patient, as it is probable that a considerable period is passed between the actual commencement of enlargement, and the occurrence of any marked symptom. One of the earliest signs generally observable is diminution in the force with which the urine is ejected, and the lapse of time which occurs before a stream is established. The size of this is not necessarily much smaller than it was in health, but it cannot be projected so far by the ordinary amount of effort. The desire to pass water becomes more frequent than natural, and the relief afforded by the act of micturition is less complete. On rising in the morning, when the bladder has become distended during sleep, the want occurs again in a few minutes, especially after the first effort; and in course of time sleep is much disturbed by calls to pass water. A sense of weight, fulness, and uneasiness about the perineum and rectum is felt, which the patient soon refers to the neck of the bladder. As the expulsive efforts to pass water become more frequent, irritation of the rectum increases, the contents of the bowel are more frequently passed from inability on the part of the patient to prevent the act of defæcation accompanying that of micturition; and tenesmus, protrusion of the mucous membrane or prolapsus, and hæmorrhoidal swellings, are apt to result. Much stress has been laid by some writers, following J. L. Petit, on the appearance of flattened stools as an indication of enlarged prostate, but certainly without sufficient grounds. In some cases the motions may be passed in the form described; but this is caused by the action of the

sphincter ani, and not by the prostate. If the complaint advances unchecked, the symptoms of chronic cystitis appear, and pains also sometimes in the penis and testicles. Occasionally, some muco-purulent discharge from the urethra is observed; this varies with circumstances, sometimes appearing after exposure to cold or damp, or with an attack of retention; while it may happen also that the irritation involves the testicles, which become tender and swollen. Vascular excitement of the penis, producing frequent erections, is also at times a concomitant symptom. As the complaint makes progress, relief to the bladder in micturition becomes less complete, since the enlargement gradually closes the neck or urethro-vesical outlet, and the bladder is never emptied, a certain portion of its contents only being expelled at each act of micturition. These difficulties, if unrelieved, inevitably increase; the capacity of the bladder yielding to the constantly-augmenting pressure upon it. Hence in time the organ remains habitually filled, and the surplus only flows off at each act of micturition. At night, when voluntary control is suspended by sleep, urine drains away, to the great discomfort of the patient. This condition is generally described as "incontinence;" a misapplication of the term, which has been productive of fatal errors in practice. A much better term is that of "overflow;" and this I shall for the future employ, as aptly indicating a condition which, so far from being one in which the bladder *cannot retain*, is one in which it *retains too much*. A sign which should be looked for in such cases is the existence of dulness on percussion above the pubes, and the degree, if present, to which it extends; it is sometimes found as high as the umbilicus, although more frequently to the extent of only three or four fingers' breadth above the pubes.

As the complaint advances, the patient's health deteriorates, and he is the subject of frequent febrile disturbances; while slight irregularities, or exposure to adverse circumstances, produce extreme distress from the severity of the symptoms occasioned. Attacks of complete retention are impending on these occasions, and the functions of the kidneys become impaired through the long-continued impediment to the discharge of their secretion. A little hæmorrhage is not uncommon, and sometimes relieves congestion: it may occur after exposure to cold, sexual excitement, or other circumstances which tend to produce a vascular determination to the pelvic viscera.

The characters presented by the urine are such as depend on decomposition of some of its constituents from abnormal reten-

tion, mixed with the products of chronic inflammation of the bladder. More or less of mucous deposit slowly falls to the lower part of the vessel, and a thin pellicle forms on the surface, which is sometimes iridescent. In later stages the mucus increases in quantity, and appears as the glairy, tenacious, slimy, adhesive matter so well known to be associated with chronic inflammation of the bladder. This sometimes exhibits traces of phosphatic matter, in masses of soft consistence and whitish colour. When the mucus has subsided, there is sometimes deposited upon it an opaque creamy-looking layer of pus mixed with crystals of the triple phosphate in varying quantity. In any stage of the complaint, the urine may be darkened in colour from admixture with blood.

The chemical reaction of the secretion is at first neutral, then alkaline in various degrees of intensity. The odour is pungent, ammoniacal, often foetid, sometimes extremely so. These characters are influenced to some extent by the quantity passed, which often varies considerably in the same patient from day to day; the measure being sometimes below, but more generally much above, the natural or healthy standard.

As a result of long-continued disorder in the urinary apparatus, and of the changes in the urine itself, which have been thus described, it is not surprising that the formation of calculus sometimes takes place. Its presence will be suspected if sudden impediment is frequently experienced to the stream of urine; if there is much pain about the neck of the bladder at or following the act of passing it; if the pain at the end of the penis is unusually severe, and if the blood and pus are very frequently observed, and especially if fragments of calculous matter have from time to time been passed. But the existence of calculus is sometimes masked by the prostatic disease, because the conformation which the neck of the bladder assumes in this affection tends to prevent the most distinctive symptoms of stone; inasmuch as the foreign body is less liable to be engaged in the vesical neck, but lies back deeply behind the enlarged prostate.

It not unfrequently happens that symptoms of enlargement exist long before the real cause is suspected: the frequency of micturition suggesting that there is undue freedom rather than obstruction to the act. The real malady is masked, and the treatment is directed only to those symptoms which have been productive of most discomfort or anxiety to the patient; to some febrile condition, it may be, resulting from the hidden cause. The march of events, however, must ultimately throw suspicion on the state of the blad-

der; a catheter is passed, and, greatly to the astonishment of the patient, some thirty or forty ounces of urine, or even a much larger quantity, may be drawn off, notwithstanding that the act of micturition has been just performed. And it occasionally happens, during the prevalence of such a state, that some unaccustomed error in diet, or exposure to cold and damp, suddenly produces congestion of the prostate, and complete retention, and so discovers the existence of the affection for the first time.

The last stage of unrelieved disease is indicated more by the signs of a gradual decline of the powers of life than by those of advancing obstruction; although sometimes the final symptoms are those of rapid depression, after sloughing or ulceration of the bladder, and repeated hæmorrhage, or from great discharge of pus from its cavity; rarely there is uræmic poisoning from failure of the eliminating function of the kidney.

Diagnosis. The test which is chiefly depended on by the Surgeon is digital examination by the rectum. For this purpose, the patient should lie on his back upon a couch, the Surgeon standing on the left-hand side, so that the fore-finger of his own left hand may be employed in the rectum, while the right hand is free to use a catheter if required, since by concerted movements of that instrument in the urethra, and of the finger in the rectum, more accurate information may sometimes be obtained than by either exploration conducted separately. The patient's knees being drawn up and separated a little from each other, the finger should be made to glide slowly through the sphincter, and when introduced as far as possible, so that two phalanges are free to move in the bowel, the limits of the prostate may be defined.

If familiar with the normal conditions of the organ, its deviations will easily be recognised by a methodical examination. We may first observe its size and form; thus, respecting enlargement, is it general or partial? affecting one or both lobes? and to what extent? It is so prominent sometimes that the tip of the finger encounters the swelling the moment it enters the rectum, and has to be depressed very considerably before it can be carried beneath the tumid organ. Instead of finding the yielding coats of the bladder in the middle line, when the finger is carried up to its fullest extent, an increasing fullness and firmness may be encountered, due to an enlargement or outgrowth from the median portion. The form of the enlargement may not be uniform but irregular in outline.

Next, we observe whether the tumour is soft, hard, or unequally

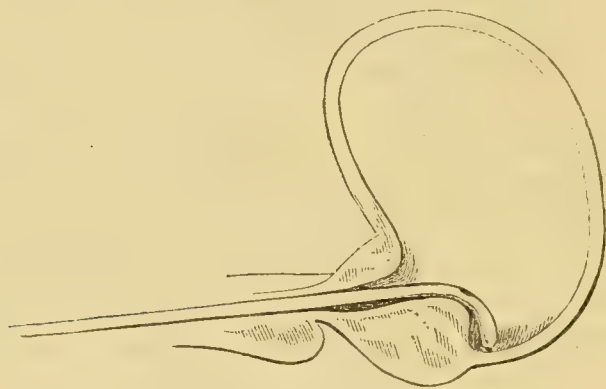
so in places; whether there is fluid in it; and whether we can appreciate fluctuation distinctly beyond it; an important consideration in a case of retention which may require the trocar. We observe also the degree and locality of tenderness on pressure. If inflammation is present, the pain will be extreme, and the mere introduction of the finger will be very distressing to the patient; in this case, heat and tension will be remarked also.

Lastly, supposing the catheter to have been previously introduced, we may, while holding it in the right hand, and communicating to it gentle movements downwards, gain an approximative idea as to the thickness of the tissue which intervenes between it and the finger in the bowel, and as to the situation and direction of the instrument, &c., in the event of there being difficulty in introducing it.

Having learned relative to these different points all that can be attained through the rectum, the urethra is to be explored. A full-sized catheter, of the form ordinarily employed by the Surgeon, should be first used, because any phenomena presented differing from those observed when the prostate is healthy are then at once made apparent. If by examination through the bowel no variation is found in regard of size, and the urine flows when the catheter has traversed not more than the ordinary distance, say from six and a half to eight inches, while the handle of the instrument itself has not required more than the ordinary amount of depression in order that its point may enter the bladder, we may be satisfied that prostatic enlargement does not exist; and we must seek for another cause of the symptoms complained of. But if the catheter has passed easily, say for nine or ten inches, and still no urine flows; and if, in addition, while following its course, the handle has become more than usually depressed, there will be little doubt in respect of the existence of prostatic enlargement. The ordinary catheter being inadequate to reach the bladder, a prostatic catheter, which measures from two to four inches longer, and possesses a larger curve than the ordinary catheter, may be employed. If it passes readily, the increased length of the urethra is easily ascertained, and the direction of the prostatic canal is calculated from the position of the shaft when the point enters the bladder. In some few cases, while the beak passes through the prostatic part of the urethra, the handle will be distinctly deflected to the right or left, from which fact, if verified by two or three trials, a greater degree of enlargement may be suspected to exist on the side *towards* which the handle turns.

For the purposes of accurate diagnosis, we shall employ with advantage an instrument of a different form, viz. an exploring sound with a very short curve at its extremity, or possessing a beak rather than a curve, which is shorter and more angular than that of the ordinary catheter. By its means not only can every part of the bladder be searched for calculus, but information respecting the form and degree of obstruction at its neck can also be acquired: see fig. 1. After the bladder has been traversed, the instrument should be gently withdrawn until the beak lies just

Fig. 1.*



within the urethro-vesical orifice, when, by turning it round to the right and left, the natural condition, if it exist, of that part can be ascertained; or, on the other hand, the presence of tumour or of stone, the depth of the fossa behind the prostate, and other relative points, can be determined. A light, delicate, and practised hand is necessary in its use.

This portion of the subject may be appropriately closed with a few remarks on the diagnosis of prostatic enlargement from stricture of the urethra, vesical calculus, tumour of the bladder, simple atony or inertia of the coats of the bladder, and paralysis.

In stricture of the urethra, the stream of urine is invariably small, in a confirmed case extremely so; in the prostatic affection, though diminished in force, it is much less so in volume than in the previous case. The use of a full-sized sound, however, marks the distinction clearly. In stricture, obstruction is encountered almost invariably before six inches of the instrument have disappeared, always before it arrives at the prostatic urethra. In enlarged prostate, obstruction is not encountered until seven, eight, or nine inches

* The exploring sound, with short angular beak, for defining tumour, or discovering calculus: in this case represented in a bladder with enlarged prostate.

have passed, and not necessarily then, for, provided that the instrument be sufficiently long, it may pass into the bladder; but the handle has to be depressed between the patient's legs in a manner not required in the normal state. Lastly, stricture almost invariably makes its appearance before middle life, prostatic hypertrophy not until that period is passed.

In regard of calculus, while many of the symptoms are common to both complaints, the occurrence of sudden cessation of the stream of urine, of severe pain at the close of micturition, the exacerbation of symptoms, especially of pain, and the appearance of a little blood after exercise, may be looked upon as strongly indicating the presence of stone in the bladder. But it may exist in the absence of most of these symptoms, the two first-named especially, from the circumstance that the calculus is usually situated behind the enlarged prostate, and does not approach the more sensitive region of the internal meatus. The fact of small quantities of florid and unmixed blood being occasionally passed after exercise, more closely approaches in value to a pathognomonic sign than any other. A persistent discharge of muco-pus streaked with blood should arouse suspicion. The use of the sound, however, can alone clear up the case satisfactorily.

The existence of non-prostatic tumour of the bladder is less easily affirmed. Compared with prostatic enlargement, there is much more pain in the introduction of instruments, the urine is frequently or generally mingled with sanious discharge and flocculi, to which sabulous matter is often seen adhering. Examination of these under the microscope may reveal the peculiar structure of villous growth; or may demonstrate that these flocculent matters consist of organised structures, not of inorganic materials, a fact possessing some significance.

Simple uncomplicated chronic cystitis, with catarrh, is by no means a common affection. Such symptoms are almost invariably due to the presence of a foreign body, to some form of obstruction, or to paralysis, or atony, depriving the patient of the power of expelling the contents of his bladder, a condition which is tantamount to obstruction. We may rely upon it, that in most of the obscurer cases there is a material cause, frequently calculus; the presence of which needs a more than ordinarily searching examination to verify.

Single or repeated acts of voluntary over-retention of urine are sometimes followed by atony or inertia of the muscular parietes of the bladder, and a state of chronic retention follows from their

consequent inability to expel the vesical contents. The condition resulting resembles much the retention produced by enlarged prostate, and requires frequent relief by the catheter in the same way, at least for a time. Here the absence of physical signs, the suddenness of the attack, its connexion with a cause generally recognised by the patient, and the diminished power of discharging the urine *after a catheter has been placed in the bladder*, especially when he is recumbent, are sufficient to distinguish this affection. Particular attention should be paid to the last-named point. In enlarged prostate, the urine often flows with considerable force when the influence of the obstruction is removed by the introduction of a catheter, and the current can be accelerated materially by the will of the patient, unless there be atony also, as there may be from undue distention; the atony, however, is not generally considerable, except in long-neglected cases. But when the cause of retained urine is not obstruction, but atony of the bladder, the urine barely flows from the catheter, and is not propelled, nor is it much influenced by any efforts of the patient.

Lastly, there is paralysis of the bladder; a condition in which its nervous supply is either impaired or destroyed. It is almost always associated with a similar condition of the lower extremities, and this may result either from disease or injury of the encephalon or spinal cord. There can be, therefore, little doubt respecting its presence; and when it does exist, the indication which catheterism presents is characteristic. An instrument being introduced, the urine is propelled by the weight of the parts around, the will of the patient exerting no influence upon its flow unless the abdominal muscles should be in a normal condition, as in cases of injury (rare) occurring to the spinal cord between the sources of nervous supply to those muscles and to the bladder, in which case a slight influence is perceptible. Otherwise no impulse is noticeable, except through the agency of acts unassociated with micturition; such as deep inspiration, coughing, sneezing, and the like, by which a momentary pressure is communicated to the paralysed bladder, and the stream is temporarily accelerated.

Treatment may be regarded under three heads.

1. Treatment for the purpose of obviating the results of obstruction caused by hypertrophied prostate.

The fact being discovered that a certain quantity of urine is habitually retained in the bladder, however frequently or forcibly the efforts to evacuate it have been made, the first thing is to insure the complete removal of the urine from the viscus at least once a day. It may be very desirable to do this twice, or even three or more times, daily, the necessity depending upon the degree of obstruction, and the consequent amount of residual urine. And

if the power of urinating is almost or quite lost, it will be necessary to employ the catheter as often as a decided want to micturate is felt. There are certain modifying circumstances which must be taken into account; such as the facilities which exist for passing instruments, and the condition of the urethra itself. If the patient possesses the ability to pass a catheter easily for himself,—and it is very rare that he cannot attain it by tuition and practice,—he complies with the demands of his case. He should be made to understand that, having his own sensations to guide him, he may soon attain considerable dexterity in the management of an instrument in his own urethra. But if this be in an extremely irritable state, which is aggravated by the frequent use of the catheter, however carefully it may be introduced, it is necessary to consider carefully the relative necessities of the urethra and the bladder, and some compromise must be made between them. In most cases, the removal of the urine night and morning suffices to maintain the reservoir in a tolerably sound and healthy condition, and it is extremely undesirable to resort to artificial aid with greater frequency than is absolutely necessary to accomplish this. For the use of the patient himself, and generally for the Surgeon, flexible instruments are, in the majority of cases, the better and safer kind.

When the necessity for a catheter is very frequent, some have advocated the plan of permitting a catheter to remain in the bladder for days together. As a rule, this is not desirable, since irritation and even ulceration may be soon produced by the instrument. Where, however, great frequency in making water exists, and ease and sleep are found to be promoted by the plan, it should be adopted for twelve hours or so at a time; as during the night, for example. In this manner it may be extremely useful. But in circumstances of urinary retention, which has been relieved with difficulty by the catheter, we may be justified in permitting the catheter to remain in the canal for a considerable period.

The consequences of enlarged prostate already alluded to, viz. the increasing retention of urine and habitual distention of the bladder, which accrue from not completely emptying it daily, form only a portion, although a very important one, of the evils which can be obviated by the habitual use of the catheter. It is impossible to overrate the benefits arising to the patient from its use; and the responsibility which is incurred by overlooking it should be ever present to the Surgeon's mind in dealing with any signs of irritability of bladder, and incompetence to retain perfectly the urine by patients in advanced years.

In relation to the treatment of chronic cystitis, catarrh, &c. arising as they so frequently do in connexion with hypertrophied prostate, see the sections thus headed, pp. 343-8.

2. The general treatment of enlarged prostate.

It is of great importance to maintain all the functions of the body in healthy action, in treating patients who thus suffer. Slight derangements in other parts of the system are very prone to augment the urinary symptoms. A simple catarrh, a fit of indigestion, or unrelieved constipation, are very apt to produce increased obstruction or greater irritability of the bladder.

All that tends to derange the stomach and bowels, to tax unduly the digestive powers, or to over-excite the circulation, must be avoided.

The clothing and the habits should be such as encourage and maintain a due action of the skin. Damp must be sedulously avoided, or removed after exposure, especially from the feet, without delay: the lower limbs should be kept habitually dry and warm; a habit of the first importance, as freedom of circulation and healthy vascular action here is one safeguard against the recurrence of congestion in the organ.

The question of exercise is one of importance. The subject of enlarged prostate must not be encouraged to believe himself too much an invalid, but must exert his physical powers, as far as they exist, in daily exercise in the open air, of which walking is the best form. Riding is generally out of the question; the movement of trotting is undoubtedly prejudicial, and bleeding

is often caused both by it and by a long drive over rough roads, or, indeed, after a long railway journey; and, at the same time, increased difficulty in micturition. To assist in producing a healthy and natural state of mind, occupation of a cheerful character, suited to engross the thoughts and energies of the patient, should be found, if possible.

3. Special treatment of the hypertrophy itself.

Although many agents have been administered for the purpose, all medical treatment has been hitherto marked by inefficiency, as to any power exhibited in effecting a reduction in the size of the enlarged organ. Hemlock, mercury, and hydrochlorate of ammonia have all been largely tried, and a certain utility has been claimed for them; but it must be confessed that there exists very little ground for regarding them as efficacious against senile hypertrophy. Iodine, however, at one time seemed to promise more success. It was formerly much employed by Mr. Stafford, who reported results of much greater value than others have since been able to obtain.

His plan consisted in administering it by suppositories in the rectum, occasionally by the mouth, and in applying it to the urethral surface of the prostate in the form of a weak ointment; commencing with one grain of the iodide of potassium to the drachm of simple cerate, and increasing it to ten or twenty grains to the drachm, sometimes even adding to this a small quantity of the pure iodine.

Regarding this as one of the most powerful and useful agents in the *materia medica*, in accomplishing the removal of enlargement when affecting various glandular organs of the body, it was natural to infer, or at all events to hope, that the hypertrophied prostate might also be favourably acted on by some preparation, either of iodine or of bromine. Their influence over simple enlargements of the uterus is undoubted, and a certain analogy between prostatic and uterine enlargements has already been pointed out. The highly-charged iodine and bromine springs of Kreuznach in Rhenish Germany have obtained a deserved celebrity in uterine cases; and Dr. Prieger, the well-known physician there, has assured me, that in the treatment of the chronic enlargement of the prostate of age also he had seen some valuable results from the employment of the waters by bathing and clysters.

But then it must not be forgotten that the embedded or isolated tumour of the prostate, like that of the uterus, cannot be regarded as much amenable to this treatment. That general hypertrophy may be thus influenced, it is not unreasonable to suppose; and it is worth while to try it, if the tumour is an example of that kind. If the patient enjoys a fair share of health, there is nothing to contraindicate it; the treatment may be pursued without exhausting the constitution, or deranging the digestive functions.

From three up to ten grains of the bromide with, at most, one of the iodide, twice a day, is the quantity which it is best to employ. It is scarcely necessary to say that this course must be persevered in for a considerable time, during which the dose may be gradually increased. Suppositories containing the same ingredients may be administered. As to their local application to the urethra, I can only disapprove of it strongly, as certainly producing much irritation, and being most unlikely to effect any benefit.

Now, although we may by perseverance in this line of treatment, and by an appropriate regimen, attain some improvement in the condition of the prostate, or perhaps be able to retard its increase, I think there is no ground for expecting to reduce the bulk of a considerably-enlarged prostate of long standing by any known means.

The influence of compression in retarding the progress of morbid growths and enlargements has been long recognised; attempts have therefore been made to extend its influence to the prostate.

Physick, the American Surgeon, first, afterwards Leroy d'Etiolles, Mercier, and others, have invented various appliances for effecting this purpose. Dilatation by water in expanding india-rubber tubes has been employed by myself. I cannot say, however, that any material benefit is often to be anticipated by any of these means. Great care must be taken to avoid causing

irritation; and if any degree of inflammation of the neck of the bladder or prostate is set up, it is almost unnecessary to say, that more harm than good will probably be produced by the interference.

Division of the obstructing portion at the neck of the bladder has been performed. Other operations have been also attempted for effecting a similar purpose, such as the excision or the crushing of a protruding portion; and even the ligaturing of a polypoid outgrowth. Respecting the division of an obstruction, bar-like in its form, elevated from the posterior border of the neck of the bladder, it is no doubt a proceeding to be accomplished without much difficulty, with the exercise of ordinary care. In most cases, although not invariably, the bar is a prostatic development, and when well marked may perhaps, in some cases, be incised with advantage, and without danger to the patient. Such was the opinion of the late Mr. Guthrie. I cannot say, however, that I have yet seen a case in which it has appeared at all advisable to practise such an operation. So much can be done by management, by maintaining the bladder in a healthy condition by means of the catheter, that the case must be rare indeed in which such an operative procedure is indicated.

In estimating these proposals, most English Surgeons will be content with awaiting further experiences in the hands of those who have hitherto seen fit to adopt them. We can cherish little hope that any benefit will be conferred on the patient by such methods of accomplishing the ends proposed, even granting that no doubt existed as to the possibility of carrying them into execution.

Atrophy of the prostate. The prostate is sometimes atrophied in old age, and occasionally it is so under certain circumstances in early adult life. It is but slightly developed in some malformations, and in constitutions in which the male sexual character is not strongly marked.

The normal weight being about four and a half drachms, it is occasionally found as low as two and a quarter, and not infrequently at three drachms, at ages between 60 and 80 years.

There are no special symptoms of atrophied prostate, nor is any special treatment indicated for patients who are the subject of it.

Malignant disease of the prostate. Malignant disease of the prostate is a rare affection; but it is probable that a few cases are lost sight of among the very large number assigned to senile hypertrophy. The course of malignant disease, when well marked, it is impossible, with ordinary care, not to diagnose from the last-named affection; but in those cases in which a malignant growth arises in a prostate previously the subject of senile enlargement, the cancerous character is sometimes overlooked.

Judging from the data at present existing, the prostate appears to be less commonly the seat of secondary than of primary deposit; the latter only will be treated of here, unless the contrary is indicated.

Malignant disease of the prostate is almost invariably encephaloid. After a close examination of all the cases reported, I adhere

to the opinion expressed by Dr. Walshe in 1846, and resulting at that time from an examination of fewer facts than we now possess, viz. that "the evidence of the occurrence of true scirrhus of the prostate is defective."

Melanotic deposit is said to be occasionally found associated with encephaloid of the prostate. Its presence is reported in two cases; one at adult age, the other in childhood. It is not to be forgotten that interstitially-effused blood in a fungous growth may be mistaken for true melanotic deposit, which to the naked eye it sometimes resembles.

Malignant disease has at present been observed only in childhood and at advancing age. No authenticated cases are on record between the ages of eight and forty-one. The duration of the disease, from the first appearance of symptoms to the fatal result, appears to vary from one and a half to five years in adults, and from three to nine months in children.

The symptoms of the malignant affection are those common to prostatic obstruction of any form, but generally declaring themselves with greater rapidity than in the cases of senile hypertrophy. Besides them, there are other and distinctive characters, such as more severe pain, often very intense; occasional, often frequent, hæmorrhages; and more or less constitutional cachexia. The pain is felt in the rectum, or in the region of the sacrum, and shooting down the thighs, either the anterior or posterior aspect.

Hæmorrhage is a common occurrence both at an early and late period in the course of the disease, always appearing at one time or another, sometimes to an alarming extent. The blood is usually voided almost pure or unmixed, and frequently after some attempt to urinate, which has been attended with greater exertion than usual. Less commonly is the hæmorrhage continuous for some time, as happens in villous tumour, for example.

The enlargement formed by the prostate itself, when examined by the rectum, is hard at first, and may or may not be irregular in outline or consistence. Softening may in the later stages be felt, but the patient's powers do not always sustain him to so late a period as that in which the growth either softens or fungates. Consequently, on examination after death, the prostate may be simply enlarged; or there may be breach of surface and protrusion of soft granulations; or there may be loss of substance and a cavity, the last-named circumstance appearing to be rare. Frequently other organs are affected, but by no means invariably. But there are always diseased lymphatic glands adjacent, and sometimes the infection

reaches more distant groups. The existence of such swellings in the course of the iliac vessels, and sometimes in the inguinal region, may frequently be verified by examination of the abdomen, and constitutes a valuable sign in relation to diagnosis.

The urine may be closely examined, in cases of a doubtful nature, for the presence of cells which may be regarded as malignant from inspection of their forms and constitution. Some observers state that they have verified cancer-cells in the urine. A good deal of débris is seen in advanced cases, its presence indicating that the growth has fungated, and throws off portions of its tissue. I have searched for characteristic forms of cancer-cell in the urine of malignant disease of the bladder, but unsuccessfully, and am not disposed to think that much reliance can be placed upon the appearance of the cells met with. The urinary passages yield epithelium cells of all forms and sizes abundantly, and these, I suspect, have been mistaken sometimes for the so-called "cancer-cell."

Regarding the general treatment of malignant disease of the prostate, nothing more can be suggested than applies to the complaint when occurring in any other part of the body. The treatment is palliative, and must be regulated according to the necessities which arise in the progress of the case.

Thus, accumulation of urine must be provided against at the smallest possible risk of irritating, much less of injuring, the part. If catheterism can be dispensed with altogether, so much the better. In no circumstances is it of more importance to be extremely gentle in the manipulation of instruments. The pain must be relieved by anodynes administered both by mouth and rectum. The addition of conium to opium, by enema or suppository, is often useful; and by the mouth belladonna is sometimes a valuable auxiliary in mitigating pain, given in doses of from one-fourth to three-fourths of a grain twice or three times a day. Hæmorrhage must be treated on principles already illustrated (p. 336). The powers of life are to be supported by every means in our power. Nutritious food, both in the solid and fluid form, with a due proportion of alcoholic stimulant, must be supplied in accordance with the wants of the patient.

Tubercle of the prostate. The prostate is very rarely the seat of tubercular deposit, and when it is so, appears generally to be somewhat increased in size, until the later stages of the complaint are reached, when, after suppuration and discharge, its volume may become smaller than natural.

At no period of the disease is the prostate affected alone, some other part of the genito-urinary tract being the primary seat of the affection. In most cases the deposit takes place first in the kidney; the organ next commonly affected, among the genito-urinary group, is the testicle. In fourteen cases collected by myself, tuberculosis of the kidney occurred in eleven, and of the testicle in six: in seven of these cases the lungs are stated to have

been diseased, they were probably so in nearly all. It is difficult to isolate any special symptoms indicative of this affection. Undue frequency and pain in making water, occasionally blood in the urine, and at times signs of cystitis, are commonly experienced. The presence of pus in the urine, of occasional hæmaturia, of pains in the loins, perineum, and penis, give rise to suspicions of calculus, to be resolved sometimes only by a careful search; no foreign body being found, the nutrition of the patient, his history, and the condition of the lungs and other viscera, will probably lead to a correct diagnosis.

Nothing need be said of the constitutional treatment of tubercular disease, and little in relation to the local manifestation in the prostate. Mechanical interference is to be avoided, and every kind of irritating application. If suppuration takes the form of external abscess, it must be treated as other perineal or ischio-rectal abscesses. But more commonly the discharge of purulent and tubercular matter takes place into the urethra. The improvement of the health, by all those numerous means which regulation of the diet, regimen, exercise, climate, and medicine enable us commonly to achieve in tubercular patients, constitutes almost the whole of the treatment to be employed in the affection, when involving the urinary or genital organs. The diagnosis once established, it is of great importance that the patient should be kept free from all instrumental treatment, which, in such cases, provokes irritation, and aggravates the disease, without conferring upon him any benefit whatever.

Cysts of the prostate. It is not at all uncommon, in making sections of an enlarged prostate, to find cavities, of an irregular form, in its substance, not met with in the normal organ. These cavities have all the appearance of being dilated follicles of the glandular structure. Ducts are easily traced into them; and frequently numerous little dark concretions lie free within. I have seen from thirty to fifty of these minute bodies occupying a cavity about the size of a grain of wheat or of a small pea.

But larger concretions, that is, of the size of pearl-barley, small prostatic calculi, may occupy each a separate recess of its own; and on removing the foreign body, a spherical, thin, and smooth-walled cavity is displayed. Sometimes hundreds of such small cavities may be found in one prostate; but this is a very rare circumstance.

The formation of these cavities, or cysts as they have been called, depends a good deal on the prior formation of concretions. At all events, the two occurrences are closely associated. We know too little of either the one or the other to affirm any thing very confidently respecting the precise mode of their formation. Most probably the cavities are nothing more than enlarged follicles, dilated caecal terminations of the glandular tubes. There are no isolated

cysts in the prostate filled with fluid, having no communication with the secreting structures around, as in the kidney; no formation, indeed, which can be regarded as analogous to that, which may be considered as the type of simple fluid cysts. Although, in conformity with the practice of other authors, I have referred to "cystic disease" of the prostate, the use of the term is scarcely warranted by the phenomena presented; and if retained, it must be held to signify a formation of a wholly different kind from that which is indicated by it in the breast or kidney.

The cavities referred to do not attain a sufficient size, nor, as far as we know, do they give rise to any symptom whatever to render a knowledge of their presence possible during life. Generally speaking, they are capable of holding not more than a few minims of fluid. In relation to practice, the diagnosis is unimportant, as no indication for treatment would be presented by the fact of their existence, were it ascertained.

The prostate is, after long-continued suppuration, sometimes converted into a kind of cyst or membranous bag; this condition can in no respect be regarded as a form of cystic disease. The organ has, in fact, disappeared, and its capsule forms part of the sac of an abscess which has replaced the normal structures.

It is doubtful if hydatid cysts have ever been met with in the prostate. Cases are on record in which retention of urine and distension of the bladder occurred as a result of a hydatid cyst *between the bladder and rectum*, near to the neck of the former; but in which the prostate was not affected except by pressure. Prostatic enlargement was very closely simulated certainly in some of them, and in two the prostatic catheter was employed under the belief of its existence. Among these cases, one or two have at times been regarded as offering examples of hydatids formed in the prostate itself. But I think evidence is wanting to show that they were so.

THE MALE URETHRA.

Congenital malformations.

Injuries.

Inflammation.

Stricture of the urethra { organic.
spasmodic.
inflammatory.

Tumours of the urethra.

Urinary abscess, acute and chronic.

Urinary fistulae.

Retention of urine.

Extravasation of urine.

Rupture of bladder (from retention of urine).

THE URETHRA.

Congenital aberrations and malformations. 1. Absence of the urethra is occasionally met with, as in cases of extroversion of the bladder, in which there is neither any cavity nor reservoir to contain the urine, nor any canal to carry it off; but a mucous membrane, corresponding with the posterior surface of the bladder and with the floor of the urethra, alone remains. For further description, see "Malformations of the bladder," p. 339.

2. The canal is sometimes occluded, and this produces retention of urine, and death during the early hours of life. The obstruction may consist merely of a membrane forming a diaphragm across the canal, or of an obliteration of some lines in length, and it may occupy any portion of the tract, but is usually found near the vesical orifice.

3. Deficiency of a portion of the urethra near the anterior orifice is the most common deformity. When a part of the upper covering is deficient, and the mucous membrane of the lower part, or floor, is exposed, the condition is termed *epispadias*; when the contrary condition is presented, the deficiency being that of the floor, the term *hypospadias* is applied to denote it. The degree of deficiency varies considerably, from a quarter of an inch to an inch and a half may be absent in either case. Occasionally, and this is only a variety of hypospadias, a second meatus exists, usually about an inch behind the normal one, opening externally through the floor of the urethra. But the opening may be much further back, and may even render impracticable the ejection of semen into the vagina.

4. Besides these, slight exaggerations in the size or form of the natural parts may be occasionally noted; as of the lacuna magna, the sinus of the bulb, and the sinus of the verumontanum. Not very unfrequently there is congenital narrowing of the external meatus, or of some portion of the passage situated within an inch of it.

Treatment. The simple diaphragm may be perforated by a trocar, or point of a bistoury, when its existence has been clearly ascertained. The congenital narrowing of the external meatus may be dealt with as stricture in that situation. None of the other conditions, with one exception, are improved by the various procedures, by paring and suture, which have from time to time been practised, nor are they sufficiently important to be so treated. But hypospadias existing or extending far back, so as to produce a practical impotence, should not, under some circumstances, be refused the possibility of remedy by surgical operation. This has been accomplished by a combination, of perforating the anterior portion of the penis, paring the edges of the opened urethra, and uniting by suture. Much care and skill, however, are necessary to give the patient any chance of a cure.

Injuries of the urethra. (See vol. ii. pp. 489 et sqq.)

Inflammation of the urethra. (See the essay on GONORRHOEA.)

Stricture of the urethra. The term stricture implies an unnatural contraction of the urethral canal, congenital or acquired. Contraction may occur in two forms: it is the nature of the first to be permanent, and of the second to be transitory only, as regards its duration. A permanent contraction is due to organic deposit in or around the walls of the urethra, and is accordingly termed organic or permanent stricture. A transitory contraction may be due either to local vascular inflammation or congestion, causing temporary narrowing of some part of the urethra, hence the term inflammatory or congestive stricture; or to unwonted muscular action alone, of the voluntary or of the involuntary fibres, in which case it is designated spasmodic stricture. This last-named condition, that of spasm, may exist alone, but is usually found as a complication of the other kinds. The term spasmodic is understood to include only cases in which involuntary contraction of the muscular fibres constitutes the main source of obstruction. So also the term inflammatory stricture can only be employed when the diminished calibre of the urethra is mainly due to an attack of inflammation.

Inflammatory and spasmodic strictures have been much confounded; either may become a cause of the other, and they frequently coexist; still the distinction between the two is very complete. Examples of pure spasmodic stricture are very rare; but the influence of muscular action upon the urethra being unquestionable, it is important to recognise it in diseased conditions of the organ, since it usually complicates most of them. Indeed, neither organic nor inflammatory narrowing of the urethra can be well imagined to occur without the coexistence, at some time or another, of some undue action of the muscular tissues around.

Leaving these affections for the present, I shall treat first of organic or permanent strictures, which are susceptible of more accurate and satisfactory demonstration as to their nature and action, and are far more important in relation to treatment and results.

Anatomical classification. Permanent or organic strictures present themselves in a variety of forms. For anatomical purposes all these may be arranged in four groups, by which means it is easy to designate any specimen, according to the physical characters of the stricture itself. It will then be only necessary, for the sake of further description, to speak of it as more or less narrow, and name the region in which it is situated.

1. *Linear stricture.* The urethral canal may be obstructed by

a thin membrane stretched across it, with an aperture in the centre, or on either side of it, and having an appearance, in relation to the rest of the passage, somewhat resembling that of the pyloric orifice of the stomach. It occasionally happens that a fold of the mucous membrane obstructs the passage at one of its sides only, forming a crescentic septum, and so obstructing a segment of the calibre of the canal: these constitute what has been called "the bridle stricture."

2. *Annular stricture.* Those instances in which the contracted part is thicker and broader than the foregoing description would include, have been termed annular strictures, which present an appearance as if a piece of cord had been tied round the canal at one point, leaving the remainder free.

3. *Indurated annular stricture.* This term may apply to those cases of confirmed stricture in which the induration is seen to extend into the tissues around the urethra, to the depth of half a line or a line: although it may be limited in extent from before backwards to a space occupying less than half an inch of the canal. The centre of the space is the point at which the contraction is most considerable, so that the affected portion presents a form somewhat resembling that of an hour-glass; and it is worthy of remark that the induration is generally thicker at the floor than on the upper aspect of the urethra.

4. *Irregular or tortuous strictures.* In a few instances, some of the natural rugæ of the urethra seem to be adherent, or even fused together, for the space of a few lines in length. In very rare cases a patch of indurated tissue is seen, resembling a cicatrix, around which the mucous membrane is puckered in radiating lines; the amount of contraction appearing to correspond with the extent of previous loss of substance. But occasionally the contraction extends longitudinally for a considerable distance, and the canal is narrowed, and its walls thickened on all sides, for a length of one or more inches. In these cases the induration sometimes involves the entire substance of the corpus spongiosum, and gives rise to the most obstinate and undilatable form of stricture.

Occasionally several separate strictures may be observed in the same subject. John Hunter records an instance in which he met with six strictures in one urethra. Lallemand and other French writers describe seven or eight. I have never been able to find any such examples. Three, or at the most four, distinct contractions is the highest number I have seen, and the latter is rare.

Origin, nature, and site of stricture. The first effect of inflam-

mation upon the mucous membrane is a swelling or thickening of it, caused by engorgement of the vessels. Then exudation of an albuminous fluid takes place into the submucous tissue, and becomes readily absorbed under favourable circumstances; the condition which exists in simple inflammatory stricture. But when the morbid action persists, more or less plastic material is thrown out, the result of which is, the formation of a fibrous tissue around the canal, causing adhesion between the mucous membrane and the submucous tissue, infiltrating the meshes of the latter, and even involving the substance of the corpus spongiosum itself.

A widely-differing condition to any of those above described has been referred to by some under the title of stricture. Sometimes, but by no means frequently, an exudation-deposit upon the surface of the urethral mucous membrane is said to cause occlusion of the canal. Few cases are on record, nor are many examples to be found in our museums; and it is now quite certain that this condition must be regarded as extremely rare.

Speaking in general terms, the degree of contraction is proportioned to the duration of the complaint, and to the extent of the inflammatory action which has existed; although the severity of the symptoms, the amount of distress, and the effects on the constitution, are by no means always commensurate with the amount of narrowing which exists. It is very rare indeed to find the urethra altogether impervious during life to the flow of urine. However contracted the canal may be, the urine still issues either in a very small stream or by drops. Retention does not depend on absolute organic impermeability. It is easy to conceive that when the canal is contracted to a mere pin-hole, the slightest cause may operate to occasion total obstruction; a little tumefaction of the part, a pellet of thick mucus, a flake of fibrinous deposit, or a very small calculus, are quite sufficient to block up the channel. Probably the sides of the urethra never adhere, and cause obliteration of the canal; unless indeed fistulæ have been established, when, although very rarely, this accident may happen in that part of the canal which is anterior to the stricture. But even then it occurs almost invariably in those strictures which are of traumatic origin. The urethra may be cut across by a wound in the perineum, and for want of proper attention the urine may pass entirely through the artificial opening, and adhesion seal up the proper passage. But such obliteration is a wholly different thing from stricture, and ought not to be confounded with it.

Locality of stricture. After a laborious investigation of this subject, respecting which there has long been much difference of opinion, comprising the examination of 270 preparations in our principal museums, I have arrived at the following results. All examples of the disease may be comprehended, in relation to this inquiry, in three distinct classes:

1. *Strictures occurring at the sub-pubic curvature, i.e.* at the junction between the spongy and membranous portions and its vicinity; the latter term comprising an inch of the canal before, and three-

quarters of an inch behind, that point, thus including the membranous portion.

That part of the urethra which is most frequently affected with stricture is the posterior or bulbous part of the spongy portion. The liability of this part to stricture appears to diminish as it approaches the deep fascia, behind which stricture is very rare. Most rarely is a stricture found so far back as the posterior part of the membranous portion.

2. *Strictures occupying the centre of the spongy portion, i. e. a region extending from the anterior limit of the preceding to within two inches and a half of the external meatus, and measuring therefore about two and a half to three inches in length.*

3. *Strictures occurring at the external orifice, and within a distance of two inches and a half of it.*

The following is an analysis of the 270 preparations referred to; they exhibit 320 distinct strictures :

Total number of strictures, 320 :

"	in region 1		215, or 67 per cent of the entire number.				
"	"	2		51	"	16	" " "
"	"	3		54	"	17	" " "
				320			

Of these

There were 185 examples of *one stricture only*, situated in region 1.

"	17	"	"	"	"	2.
"	24	"	"	"	"	3.

There were 8 cases in which the urethra was strictured in all three regions.

"	10	"	"	"	in region 1 and 2 only.	
"	10	"	"	"	"	1 " 3 "
"	13	"	"	"	"	2 " 3 "

Respecting so-called "prostatic stricture," it may suffice to state that there is not a single case of it to be found in any one of the public museums of London, Edinburgh, or Paris, nor have I ever met with an example. It must be concluded that some observers who describe prostatic stricture have been deceived in reference to it, or that it owes its supposed existence to inferences drawn from the results of examinations of the living body, which can by no means be admitted as evidence on this subject.

Causes of organic stricture. There are two principal and distinct species of lesion which give rise to the formation of stricture of the urethra. The first, and that which by far the most frequently operates, is inflammation in the canal; the second is, injury by violence.

The first-named process, viz. the inflammatory, in the great majority of cases, fortunately terminates by resolution, and leaves the urethra as healthy as before. Whether the urethritis be gonor-

rhœal, or of non-sexual origin, this is the ordinary result. But in exceptional cases, occurring in some instances probably from indiscretion on the part of the patient, in others from violent treatment, and in others from a constitutional indisposition to terminate inflammatory action, this latter persists and extends from the mucous membrane to the submucous tissues, and to the erectile structures around, throwing out plastic matter, which, not being reabsorbed, becomes organised, glues together the organic muscular layer which immediately underlies the mucous membrane, and incapacitates the fibres from performing their function of relaxing when patency of the canal is required. Habitually so arranged as to effect the closure of the urethra, these organic fibres become more or less permanently fixed in apposition by the plastic lymph which has permeated their connexions; and in this manner an organic constriction is produced.

Whatever be the cause of the inflammation, such is the process which constitutes it the cause of stricture. As before said, gonorrhœal inflammation is the chief and common agent. But it is not the acute complaint, so much as a persisting chronic or subacute affection, which seems to lay the foundation of organic stricture. Hence a long period often elapses between the acute attack and the first symptoms of obstruction. These latter appear often very insidiously and slowly, and at first perhaps scarcely excite the attention of the patient. Thus it is that a period of many years is often passed before the existence of the organic change has become obvious.

The next principal cause of stricture is mechanical injury. Blows on the perineum, bruising, lacerating, or partially destroying the urethra, are received in a variety of ways: by falls on some hard object, as across spars, scaffolding, ladders, chairs, gates, wheels, saddles, &c.; or on some sharp object which punctures the perineum, as pallisading and other fences, from earthenware vessels which break under the sitter, &c.; again, laceration may occur from the bones in pelvic fracture; lastly, all violence in the use of surgical instruments must be admitted as another traumatic cause. In all these cases the wounded urethra often unites irregularly, or loss of substance takes place, and the cicatrix resulting permanently contracts the part. The strictures so formed are among the most obstinate and difficult to treat which come under our care.

An occasional cause of stricture is cicatrization following chancreous or other ulcers which have occasioned loss of substance. The results of these are usually observed at the external meatus. After amputation of the penis, the opening of the urethra is also sometimes narrowed in a similar manner.

Narrowing of the urethra, occurring generally within half an inch or an inch of the external meatus, is occasionally met with as a congenital formation. It is remarkable that it may exist up to the period of adult life without occasioning the smallest inconvenience, indeed without being discovered, and subsequently become the source of severe symptoms. The tissue appears to become in later life less extensible, and to interpose a serious obstruction to the outflow of urine.

Symptoms. Among the early symptoms, slight urethral discharge is often noted, and its presence sometimes masks the true cause. Pain is usually felt in the urethra, behind the stricture, at the time of micturition. The contents of the bladder are emptied at shorter intervals than has been natural. The stream is altered in form, becoming more or less flattened; perhaps twisted, spirting, forked, or even divided; which conditions are caused by the current of water being insufficient in size and force to dilate and extend the lips of the meatus externus; but it must not be concluded that the mere existence of such a stream is a proof that stricture exists, since many persons, from a tumid condition of the meatus alone, habitually pass such a one. As contraction increases the stream grows smaller, the momentum of the current is lost, and in time the urine may issue only by drops. Generally speaking, the act of micturition is always prolonged to an extent corresponding with the degree of obstruction present. Ultimately the acts of micturition become very frequent and painful, some patients being compelled to rise from bed many times in the course of the night; while in the worst cases, or during temporary exacerbations, a great portion of the time is spent in laborious and unavailing efforts, by change of posture or by straining, to obtain some relief. Tenesmus of the rectum is thus often induced, leading to protrusion of the mucous membrane through the external sphincter, and sometimes to troublesome prolapsus. In bad cases the patient can rarely attempt to empty his bladder without visiting the water-closet, through his inability to prevent the escape of the contents of the rectum from the efforts required for that purpose. Pains in the perineum, the testicles, the loins, and the hypogastric region, are usually present in such cases.

In some few cases the most prominent symptom throughout is retention. There may be but little irritability of bladder, and the stream of urine, when passed, is not necessarily very small; a No. 6 or 7 catheter may pass through the urethra; but a true organic stricture is present, and may perhaps be verified by the touch, as a

ing of indurated material in the course of the urethra. The patient is liable to frequent retention, and finds no relief but from catheterism, while attempts at dilatation are followed by inability, more or less prolonged, to pass water, until an instrument of very large size has been reached.

The urine also shows signs of change, which become more marked in proportion as the case advances. A portion being retained in the bladder, from inability to overcome the obstruction, the secretion becomes partially decomposed, and irritates the mucous membrane; and thus urine, cloudy, ammoniacal, and depositing as it cools a quantity of pus and mucus, is not an unfrequent accompaniment of stricture. It is usually alkaline, deposits slimy tenacious mucus, and also a precipitate of the prismatic crystals of the triple phosphate of ammonia and magnesia, of exudation or compound granular corpuscles, epithelium, and some pus; while on its surface an iridescent film or pellicle collects, commonly consisting of the triple phosphate, and sometimes of the phosphate of lime. Hæmaturia is also one of the occasional concomitants of stricture. Blood sometimes comes from the bladder, in small quantity, communicating a dark tint to the urine. It frequently follows the use of the catheter, but it appears also when no instrumental interference has taken place; or it may be due to the rupture of vessels during erection, the urethra being unduly confined by the presence of the stricture, and strained by the act (see Hæmaturia, p. 335).

Retention and engorgement. As the case advances, attacks of complete retention, depending on the causes above mentioned, become more frequent. The urine is at length habitually discharged by drops, so that a stream cannot be said to exist. Sometimes the urine passes away involuntarily during the unconsciousness of sleep, or during muscular exertions; and at length the patient loses the power to retain it altogether. At this stage "incontinence" is often said to occur, which term does not here apply either to an irritable or to a paralysed condition of the bladder, incapacitating it to retain its contents, although it has frequently been mistaken for this. The urine constantly dribbling off infects the patient with a urinous odour, and, despite all precautions, excoriates the skin, stains the clothes, and renders him offensive to himself and others. But these symptoms, in nine cases out of ten, indicate that the bladder is distended, and that the surplus only runs off in the manner described, the organ remaining filled with the staler portion of the urine, unless it be frequently emptied by the catheter. Thus it is a state of retention, or of engorgement, rather than of incontinence. The

extent of dulness on percussion over the pubes will indicate this condition, and also the size of the tumour formed by the distended viscus. Under these circumstances disease of the bladder is increased, and disorganisation more readily induced than before. Thus ulceration may occur in its mucous membrane, or in that of the urethra behind the stricture. Under such circumstances, in a paroxysm of straining to pass water, rupture of the urethra may take place, and extravasation of urine occur into the cellular interspaces in the perineum, scrotum, and supra-pubic region (see Extravasation of Urine).

Besides the local symptoms of stricture, there is usually disorder of the digestive organs, followed by the consequences of impaired nutritive function. The patient loses flesh and strength, looks anxious and careworn, complains of pains in the back and loins, and often becomes the subject of severe attacks of shivering. Others invariably experience rigors after the passage of a bougie, or if an instrument but one number larger than the accustomed size be passed. Such an occurrence appears to be more common among those who have long inhabited warm climates. The application of an irritant or corrosive substance to the urethra is also not uncommonly followed by some general fever. So well known is this phenomenon, that it has received the special name, and not inappropriately, of "urethral fever." It often occurs after the first act of micturition following the application of the irritant, as if from contact of urine with the abraded urethra, or with the wound if incisions have been made. Sometimes it is intermittent in its character. When renal disease exists, these symptoms are more prone to occur; so that we may suspect the presence of such disease when severe rigors constantly follow slight urethral irritation in patients not predisposed, by climate or otherwise, to experience them, and who have suffered for some time from stricture. I have observed, on more than one occasion, suppression of urine, rapidly followed by death, to result from the introduction of an instrument larger than the patient has been accustomed to; or again, when the ordinary instrument has been less skilfully employed, and an abrasion, although only an exceedingly slight one, has been made in the mucous membrane of the urethra. The rapidity with which death may occur, under these circumstances, in patients who are the subjects of extensive chronic disease of the kidneys, from an apparently exceedingly trifling lesion so caused, is remarkable. It seems to be due to uræmic poisoning; the post-mortem appearances, to the naked eye, do not necessarily exhibit traces of inflammation resulting

from the particular lesion. In these cases it appears that the function which determines the elimination of urea suddenly ceases after slight injury to the urethra, as by the propagation of some shock to the excreting organ, in cases where the kidneys are largely diseased. And there are undoubtedly sometimes, although rarely, instances in which the fatal result ensues in this manner from the mere passing of a catheter, although it is absolutely certain that no mechanical injury whatever has been inflicted.

From the symptoms which present themselves three classes of organic stricture may be made, which will embrace all the varieties of the disease, and so serve as a means of describing in brief terms any particular example in the living patient.

1. *Simple stricture.* Its chief sign is diminution in the size of the stream; there is increased frequency of micturition also with some pain, although the amount of either varies greatly in different cases.

2. *Sensitive or irritable stricture.* Proneness to disturbance of the nervous system, as evidenced by chilliness, irregular circulation, or even rigors on very slight irritation. Great pain is caused even by the gentle application of instruments, and it continues sometimes long afterwards. In a few cases also a disposition to hæmorrhage is manifested.

3. *Contractile or recurring stricture.* There is constant tendency to become narrower in the absence of treatment; and contraction rapidly recurs after dilatation has been applied.

Diagnosis and treatment. *Dilatation.* The symptoms just detailed are not sufficient alone to establish the presence of stricture: it is necessary to examine the urethra with an instrument to ascertain whether an organic obstruction exists, whether one or more are present, their calibre, and what extent of the canal is involved.

For this purpose instruments of various forms and compositions are used: some are soft and pliable, others elastic, others inflexible and solid. As a rule, to which there are unquestionably exceptions, the latter description is to be preferred; first, because there need be no doubt as to the direction which the point of a solid instrument takes in its passage; and secondly, because the movements which the point makes can be exactly controlled and determined by the hand which holds the opposite end of the instrument.

Catheters and bougies may be either straight or curved. Generally speaking, those which are moderately curved pass with the greatest ease both to the operator and to the patient. The best curve, perhaps, for common use is that which corresponds most nearly with the bend of the urethra at its inner third, and which

may be regarded as approximating to that described by an arc rather less than one-fourth of the circumference of a circle $3\frac{1}{4}$ inches in diameter. Straight instruments may be easily passed with ordinary care; but they are not to be preferred, and not commonly to be employed except for strictures in the ante-scrotal portion of the urethra.

In introducing the catheter, a uniform plan should be followed. If the patient stands, the heels should be a little apart, the nates resting lightly against the wall or similar support behind. An appropriate instrument having been selected, it should be warmed, and smeared with oil or lard. In introducing it, the handle should be lightly held between the thumb and the fore and middle fingers of the right hand, the concavity of the curve looking towards the left groin of the patient, and the general direction of the instrument being almost horizontal. The penis is to be raised with the left hand, the point of the instrument inserted into the urethra and slowly carried onwards until four or five inches have disappeared; the handle is brought to the middle line at the same time, at first close to the patient's abdomen, after which it is to be gently and lightly depressed; and as the point is felt to traverse the sub-pubic curve, the handle is gradually brought down towards the operator, until it sinks beneath the horizontal line, when the opposite extremity will be free in the bladder. If difficulty occurs, the direction of the instrument may be slightly altered, or it may be withdrawn an inch or so, and then re-introduced with the handle more upright than before, or the reverse, as the case may require. If, notwithstanding all, the instrument is stopped point blank, and at the same spot on each trial, there is reason to suppose that stricture is encountered. On the other hand, if the urethra is healthy, a solid sound of good size will pass almost by its own weight if lightly handled; at all events, a very slight pressure from the fore-finger upon its handle will be amply sufficient, if additional impetus be required. It is never to be forgotten that a powerful lever is in action when the handle is depressed, the resistance of which bears on structures which may be easily perforated if undue force be applied. Whatever the obstruction, it is never to be forced: temper, patience, and a light hand will overcome almost all cases of difficulty. All attempts at rapidity of execution are wholly out of place, fraught only with danger to the patient, and calculated to reflect discredit on the operator.

That mode of passing a catheter which has obtained the term of the "*tour de maître*," is only rarely advisable. It consists in

introducing the instrument with the convexity of its curve upwards, and with the handle in a perpendicular line beneath; in carrying it to the deep perineal fascia in this direction, and when it has arrived at that point, in sweeping it round adroitly so as to describe a half circle, of which its point is the centre; at the same time gradually depressing the handle to carry the instrument through the sub-public curve.

In the majority of cases, the recumbent position is best, especially if much time is required for the purpose. The head and shoulders should be slightly elevated by pillows, and the knees a little raised and separated from each other; the operator should stand on the left side of the couch, hold the catheter as before directed, and introduce it over the patient's left groin, the handle being in the horizontal direction; he should support the penis with the left hand, placing the palm upwards, so that the middle and ring-fingers hold the penis just behind the corona glandis; the index-finger and thumb are then at liberty to be applied for the purpose of retracting the prepuce if necessary. The beak of the instrument having been introduced, it should at first be maintained against the inferior wall of the canal to avoid a lacuna on the roof, sometimes considerably developed; an accident which gives the patient pain, and sometimes disconcerts an operator. The fingers of the left hand gently draw the penis over the instrument as it glides easily on to the bulbous part, the handle still being horizontal, or nearly so; arrived at which, if some obstruction seems to offer, the instrument should be withdrawn an inch or so, and again passed, taking care not to elevate the handle so soon; after which, by gently raising it and causing it to describe a curve along the middle line, the extremity will probably glide slowly upwards into the bladder as the handle sinks towards the interval between the patient's thighs.

In exploring the urethra, especially if the symptoms are not well marked, we are not hastily to conclude, because a little obstruction presents itself in the passage, that stricture is of necessity present. The part is extremely sensitive, and resists any but gentle efforts to traverse it, the more so if it be the first time an instrument has been introduced. Sometimes at the neck of the bladder itself a little more than usual depression of the handle of the catheter is required, or it may be necessary to employ an instrument with a stronger and longer curve.

The size of an instrument to be first used is by no means a matter of indifference. As a rule, whatever statements the patient may make, we should *always* use a bougie or catheter, not smaller

than No. 7 or 8, with a blunt, not conical, extremity, as such will afford far more certain indication of the situation of the obstruction than smaller sizes, which might pass through a slight constriction altogether; or whose point may be entangled in a lacuna, or in a fold of mucous membrane, the first of which would have been closed, and the second obliterated, by the passage of an instrument sufficiently large to fill the urethra. By such entanglement, perhaps, injury may be inflicted on the canal, or the unfounded belief in the existence of abnormal obstruction in it may be induced.

Suppose, however, that a stricture is encountered, its distance from the external meatus should be accurately noted and its situation remembered. Then a smaller instrument is to be passed, in order to determine the calibre of the stricture; if this enter the contracted part, it is at once obvious by its being "*held*," *i.e.* it has entered a narrower passage which fits closely to and retains it, so that on attempting to withdraw it, some force is necessary for the purpose. A trial of several instruments may be necessary, until at last one which is sufficiently small to enter the constriction is arrived at: but we should always bear in mind that the smaller the instrument the more careful and the more sparing of pressure must the operator be, since such an instrument will inflict a wound with ease directly proportioned to the smallness of the point.

The instrument should next be carried on by way of search for another stricture, especially if the first be in the anterior part of the canal. It may, however, be so firmly grasped, and its freedom of motion be so interfered with, that it is not easy to judge accurately with respect to obstacles situated deeper in. If so, another kind of sound may be used with advantage, *viz.* one of small size, having a bulbous or olive-shaped extremity two or three sizes larger than the stem; this being made to pass with some little difficulty through the first stricture, it will be apparent enough when the bulb becomes free on the farther side, and the existence of another contraction will be more readily diagnosed than with an ordinary sound.

Some operators have strongly advocated the use of a wax bougie with a softened point, for the purpose of obtaining by gentle pressure what they believe to be an "*impression*" or "*model*" of the stricture. I have nothing to add respecting the merit or advantage of such a proceeding.

Treatment. Its object is twofold:

First, to restore the natural calibre of the canal, so far as is consistent with the safety and comfort of the patient.

Secondly, to maintain the adequate patency of the canal afterwards.

Now, since strictures vary in amount of contraction, in dilatability, in dis-

position to return, in local sensibility, and in liability to manifest sympathy with other parts of the body, &c., various modes of treatment are necessary, appropriate to different cases. Hence innumerable inventions for the fulfilling of the above indications have been described, and modes of treatment proposed. All, however, may be resolved into three classes. The opposing tissue of the stricture is either dilated, gently or forcibly; or it is wholly or partially destroyed by chemical agents; or it is divided by some cutting instrument; and of course all these processes may be more or less combined with certain general or constitutional treatment.

Dilatation. This is the mildest and the most desirable treatment to employ whenever the case admits of it; it is also the most generally applicable, and the best adapted to a very large proportion of all the cases presented to our notice. It is the method which almost all Surgeons agree to use as the rule, availing themselves of other means when its action is either not effective on account of the impermeability of the stricture, or insufficient to enlarge its calibre from the unyielding nature of the obstruction, or impracticable from the acute sensibility of the urethra. The history of surgery shows that it is still the most ancient mode, having been employed for the destruction of "carcinomata" in the time of Galen, and never having been superseded to the present day.

To apply it in ordinary cases, a solid sound or a bougie, as large as the stricture will easily admit, should be passed fairly through it, and then be at once withdrawn with as much care and gentleness as was employed in introducing it: a note of the size should be recorded, and the patient desired to come again in three days: the same sound may then be passed, perhaps with greater ease than before; if so, it is to be withdrawn at once, and the next size larger introduced, provided it requires no undue force to do so. The visit may be repeated in three days, sometimes in two (but not sooner), if neither pain, nor bleeding, nor much smarting in micturition, follow and continue after the operation. Sometimes a fit of shivering occurs, or the patient may be faint or sick, which are not unfrequent effects of the passage of an instrument, more especially for the first time. If any of these phenomena take place, the interval should be lengthened a day or two, and the condition of the health examined. If the patient complains of soreness of the urethra, and that micturition is painful, the urine is, perhaps, unduly acid, and it will be desirable to regulate his diet and habits so as to promote a healthy character in the secretions generally. At the same time, if it be so, he will generally derive benefit from a little bicarbonate or citrate of potash, combined or not, as occasion may require, with hyoscyamus, and taken three or four times a day; or, the alkali may be given in decoction of uva ursi, or infusion of buchu, if the mucous membrane of the bladder seems to be irritable, or disposed to secrete too freely. Irritability of the urethra, however, is much allayed by the gentle and careful use of instruments. Even when much suffering is produced at the first attempt, it usually becomes notably less at every succeeding passage of the sound. In some cases, however, where much pain is experienced in passing metallic sounds, a wax or gum-elastic bougie may be easily borne, and will then be more efficient.

Supposing none of these consequences to happen, the same plan of gradual advance may be continued at each visit, so that No. 10 or 11 may be soon safely reached in such a case as that described, when a very fair amount of dilatation has been achieved: if the urethra is of the ordinary size, if the last step or two in the progress have been easily made, without pain or annoyance to the patient, it is well to go on to No. 12 or 13. Finally, the maximum point of dilatation arrived at, should be maintained for a short time, the largest-sized instrument employed being used at gradually increasing intervals of time, in order to maintain the ground which has been won.

If, however, the case is more difficult, and after the use of a smaller instrument no penetration is effected, it is desirable to see the patient make water; if the stream is small, the size of the instrument should correspond with it; if it is not, the contraction cannot be very considerable, and some fold of membrane, or perhaps a false passage, has entangled the point; and in any case the sound to be tried next should be as nearly as possible of the size of the stream.

In introducing it, the floor of the urethra, as well as any lateral deviation in its course, are to be avoided, these being favourite situations for false passages. Failing of success in one direction, we should next cautiously carry the point towards each of the others, trying patiently for a short time to insinuate it either above, below, or on either side of the passage, if the slightest sensation of its being "held" indicates that the orifice exists in any of these directions. And when the instrument has thus become a little grasped, we should endeavour to facilitate its progress by patient, continued, and moderate pressure, the precise amount of which should be proportioned to the degree which the patient will bear without much complaining. Some minutes should be devoted to the attempt, the success of which will much depend upon the steadiness and singleness of purpose with which it is pursued. Sometimes the introduction of the left fore-finger, previously oiled, into the rectum, will facilitate the progress of the instrument, either by permitting its point to be raised to some extent, or by enabling us to judge more precisely of its exact locality and relation to the parts around.

The employment of continued pressure on the face or commencement of an indurated and not very sensitive stricture, is sometimes successful, either by inducing absorption, or by mechanical action upon the yielding materials of the obstruction. The operator, however, should be certain that he is really acting on the contraction, and not following or making a false passage. It is important to remember, as an invariable rule in relation to these attempts, that when the instrument is tightly grasped, the operator may infer that its point is safe within the strictured part, but that when the point feels free, movable, and capable of being withdrawn without appreciable effort, it is certainly not in the stricture; it may be, in such circumstances, in a false passage. If, after being grasped or "held," it advances suddenly for a short distance under pressure, and becomes movable, it is probable that a false passage has been made and the urethral walls perforated; after which unfortunate occurrence all further efforts must be given up, at least for several days, and the employment of instruments, when again resorted to, must be conducted with vigilant care, to avoid any re-opening of the lacerated part.

If after several applications of the instrument the stricture is still not passed, or if the case at its commencement appears to be more than usually difficult, we must take still further precautions to insure success. It is preferable to visit the patient when in bed, with the skin warm and moist from ample coverings. A hot hip-bath just before the visit is sometimes advantageous. When introducing the instrument, all unnecessary exposure should be carefully guarded against. Premising that the situation of the stricture has been carefully verified beforehand, a silver catheter should be selected, the size of which should be a little less than that of the stream of urine. Next, it is obvious, when oiling the instrument, that the smaller it is the less will be the quantity of oil which adheres to it. It is desirable, therefore, to apply the oil *to the urethra itself*, rather than to the instrument, injecting, by means of a common glass syringe, four or five drachms of olive-oil. This proceeding facilitates the progress of a small instrument to the stricture, and tends to open the latter by the penetration of the oil into the narrowed passage itself.

When the stricture has been passed, considerable care is necessary in guiding onwards the point through the canal behind, to prevent its becoming engaged in the enlarged lacunæ which are commonly found here. These are usually on the floor; and not a little patience and management are sometimes required to carry the point of a slender instrument over them and lodge it safely in the bladder. Usually the point has to be tilted upwards somewhat; and here it is that the finger in the rectum is most commonly of use.

False passages are some of the most perplexing complications of a narrow stricture which the operator has to deal with, inasmuch as the difficulty of getting into the right opening is greatly increased by the readiness with which the instrument enters the wrong one. It is to be remembered that, as a rule, false passages most frequently commence on a level *below* that of the proper opening; and that the operator's finger when in the rectum, near to which the false pass-

age is almost certain to run, will inform him as to the route which the catheter is taking, whether it be too close to the gut or deviating to the right or left of the median line, and will also assist him to direct the point in its true course.

The influence of chloroform has been sometimes found extremely useful in facilitating the passage of a catheter or sound through the urethra, especially when it is more than ordinarily sensitive, and the pain occasioned by instrumental interference produces uncontrollable and involuntary efforts of resistance on the part of the patient. It is to be remembered that it is not for the purpose of permitting the instrument to be used with greater force than before, but in order to produce relaxation of the muscular tissues, both of the voluntary and involuntary kinds, that the chloroform is administered; and it must, of course, be given to a sufficient extent to insure this result.

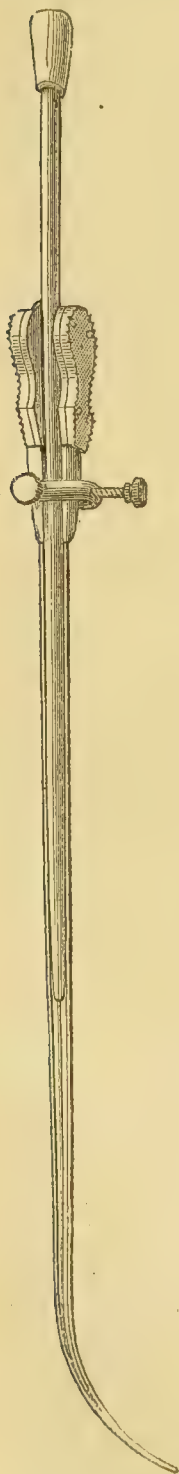
Continuous or permanent dilatation. A very useful means of rapidly dilating a stricture which has been obstinate under ordinary treatment is that of retaining the catheter in the urethra for forty-eight or seventy-two hours at a time, without removing it. Especially when great difficulty has been encountered in its introduction, this treatment is frequently of great value; if, owing to extreme sensibility, each introduction of an instrument is followed by much pain or by rigors, it is sometimes one of the most efficient methods which can be adopted. In putting it into execution, a week or two of confinement to the house must be reckoned on. The catheter having been introduced, it may be fastened by bandages round the body; for this purpose one may be carried round above the hips, another is connected with this, on each side, near the crest of the ilium and passed under the thigh, returning again to the crest, and then made fast. The catheter is then secured by a piece of narrow tape to the bandage on each side near the tuber ischii. A peg of wood is fitted to the orifice of the catheter, or, better still, a piece of india-rubber tubing attached, with the other end in a suitable vessel. Or if it be a gum catheter, it may be attached to a piece of plaster lightly encircling the penis.

In the management of this process, three points should be attended to: first, the catheter when tied-in should not project into the bladder, or at any rate but very slightly; the proper distance is readily ascertained by observing the flow of urine through it, and drawing the instrument outwards until the stream just ceases; a very small portion only of the catheter can then remain within it. Secondly, if the first catheter passed has been a silver one, the succeeding instrument should be of gum-elastic, as causing less irritation, indeed rarely any, while the process of dilatation is quite as efficient as when metal catheters are employed. Thirdly, in no case should an instrument be permitted to remain in the urethra which fits tightly in the stricture; more real progress will be made by always using a catheter which lies loosely in the canal, than one which is large enough to be grasped by the contracted portion, while in the latter case irritation is liable to be caused, which may produce unpleasant consequences. During the period of remaining in bed, the patient may sometimes take fifteen or twenty grains of nitrate of potash four or five times daily, in as much water, or barley-water, as he pleases, for common drink; and a little hyoscyamus or opium, if pain or irritation render it necessary. The latter may be given in the form of suppository; but this is rarely necessary if proper care is taken in the management of the catheter, which is the most important part of the treatment. If, however, blood appears in the urine, or fever, or swollen testicle, the catheter must be withdrawn at once.

Usually, in about thirty-six hours, a purulent discharge is seen around the instrument, which soon becomes loose in the canal, although when first introduced it may have been firmly retained by the stricture. It may then be replaced by another two sizes larger, which will probably enter easily. In a day or two a similar advance may be made; and if all go well, this progress may be continued for five or six days; the patient sitting up daily for a few hours, if the gum catheter is employed. If he is fatigued, a day or two's rest may be given, and the plan resumed if necessary. When a full size has been reached, the catheter is to be withdrawn, and an instrument passed daily for a few days, gradually increasing the interval, but endeavouring to retain as much as pos-

Fig. 2.

The instrument employed by Mr. Holt.



sible of the calibre gained; a certain degree of recontraction at first, however, is always met with.

Mechanical apparatus for effecting dilatation. Among various forms of special apparatus may be noticed a method adopted by Mr. Thomas Wakley, which consists in sliding tubes over a small urethral guide first passed into the bladder; so that if the route is at first correctly taken, all the other tubes will follow the same course. Different methods of using sliding tubes were formerly adopted by Dr. Buchanan of Glasgow (1831), Dr. Hutton of Dublin (1835); by Desault (1797), and Maisonneuve (1845). The attempt has been frequently made to dilate a stricture by means of a single instrument which expands in situ, in the place of several instruments of increasing calibres which require to be successively pushed through the constricted part. With this object Mr. Luxmoor (1812) employed diverging metal rods; Leroy d'Etiolles the same method, some years later; and M. Perrève a somewhat similar plan (1847); Dr. Arnott commenced the employment of fluid expansion (1819). In a lesser degree, the accomplishment of the same object has been attempted by the use of cat-gut bougies, and very recently by bougies of Laminaria, a species of seaweed which expands in contact with moisture. A German Surgeon formerly, and Reyhard of Lyons more recently, have employed metallic expanding instruments for the same purpose; although the latter chiefly employed such instruments for maintaining apart the incisions after urethrotomy. But he proposed this method also for effecting dilatation by progressive steps, with the view of carrying it to a higher degree than could be attained by any instrument the extent of whose expanding power is limited by the size of the external meatus, which is well known to be the narrowest part of the urethra. More recently, Mr. Holt has adopted the method of forcible rupture by means of an instrument precisely similar to that of Perrève, and has operated many times with success, and a greater freedom from serious consequences than would generally have been supposed, since he ruptures the stricture with considerable force.

In considering these, and numerous similar means which have been employed, it is impossible to forbear remarking that the essential part of the process of *dilatation* (I mean dilatation as distinct from rupture) is a vital, and not a mechanical one, and that complicated apparatus is not so efficient for that process, or so desirable as the employment of a simple sound when passed with tact and gentleness, and with a light hand. Were catheterism simply an affair of overcoming mechanical resistance, the expedients of the engineer would naturally commend themselves; but we must remember that, in the prosecution of dilatation, where the object is to avoid producing lesion, the delicate tube of the urethra and its important connexions are to be treated as tissues endowed with vital functions and relations of the highest importance.

On the other hand, it is a remarkable fact, which I have now completely verified, that while an old and obstinate stricture may be dilated up to a certain moderate degree, beyond which the slightest advance sometimes produces severe constitutional symptoms, the same stricture may be distended or ruptured at once up to the natural calibre of the urethra without any such symptoms. I have seen this as the result of Mr. Holt's method, and also from the use of an instrument employed by myself, which distends the stricture alone to a calibre of 14 or 16 of the catheter-scale, but without involving

the healthy part of the urethra in its action. If, however, forcible dilatation be applied to an old and rigid stricture, after the method in vogue thirty or forty years ago (Mayor), that is by driving a large conical metal bougie through the obstruction, severe symptoms are almost infallibly incurred. Force so employed, and not exerted from within outwards as in the distending instruments referred to, pushes the stricture down the canal, loosens its cellular connexions, and infallibly produces inflammation and fever.

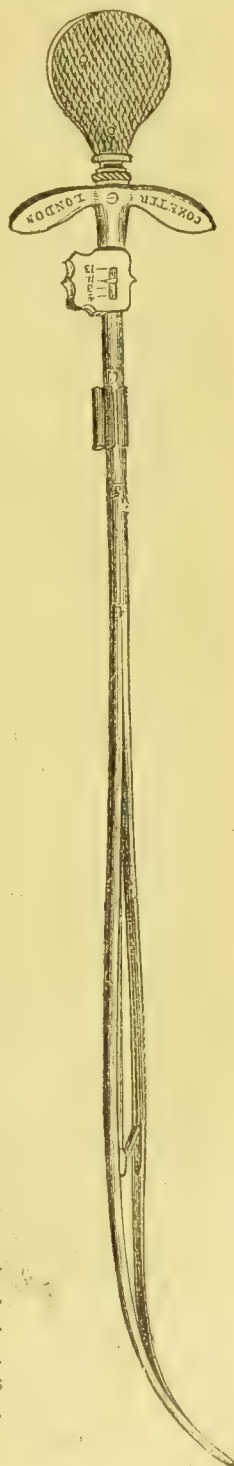
Mr. Holt describes his mode of operating as follows: The instrument "consists of two grooved blades fixed in a divided handle, and containing between them a wire welded to their points, and on this wire a tube (which when introduced between the blades corresponds to the natural calibre of the urethra) is quickly passed, and thus ruptures or splits the obstruction." Having introduced it, and "reached the bladder, the dilator should be gently rotated, to prove that it is fairly within that viscus; and being thus assured, the Surgeon is next to place the point of the tube he had previously selected upon the wire between the blades, and thrust it quickly onwards to the end. The stricture being now fairly split, the dilator should be rotated, to still further separate the sides of the rent, and then be withdrawn; a catheter corresponding to the number of the tube being substituted for the purpose of removing the urine."* The catheter is then removed, the patient treated with quinine and opium for the first twenty-four hours; and the same catheter introduced in forty-eight hours; and again on alternate days for a week or two, gradually lengthening the interval.

We are under obligations to Mr. Holt for perseveringly pursuing his practice by rupture, by which the remarkable facts previously referred to have been demonstrated. I do not hesitate to say, that many of the cases which have hitherto resisted dilatation may be successfully dealt with by that method, whether applied in his manner or by my own. The cases in which these methods appear most likely to be valuable are those in which the morbid material constituting the stricture does not form too thick or dense a mass to be entirely ruptured. Where the stricture forms a large and hard nodule, it may, perhaps, be better to divide it with a cutting instrument. For many, however, of the cases which have been hitherto so treated, I believe the plans in question offer considerable advantages. To rupture a stricture appears at first sight a harsh and rough proceeding; but a careful and unprejudiced examination of its results on a large scale, and some personal practice of it, has convinced me that it deserves the character accorded to it here.

The plan which I have adopted and prefer is as follows: The instrument consists of two long and narrow steel rods, accurately applied to each other, but both forming when closed a cylindrical instrument the size of No. 3, 4, or 5. These rods are united at each end and throughout four inches of the shaft, and are surmounted by a handle containing a screw, which when turned causes the rods to diverge from each other very slowly and gradually, at a given spot, forming a spindle-shaped figure three or four inches in length, and the third or half of an inch in diameter.

Fig. 3.

Distending instrument: the blades are opened to the full extent. The index is seen just below the handle.



* *The immediate Treatment of Stricture.* B. Holt. London, 1861, p. 7.

There is an index near the handle which shows the exact degree of distension made, by pointing out that number of the catheter-scale which is reached, as the operation proceeds (see fig. 3). The reason for carrying distension beyond the size which the meatus of the urethra will admit, is the fact, too often overlooked, that the great majority of strictures, that is, those situated at or near the bulbous portion of the urethra, occupy a part of the canal which naturally possesses a calibre of at least 16 or 18 of the catheter-scale, and that ordinary dilatation up to No. 10 or 12 inefficiently acts upon them. The method of applying the power by this instrument differs materially from that in others, in being made very slowly (better therefore under the influence of chloroform), so that from seven to ten minutes are occupied in slowly reaching the maximum point of distension; the object being to overstretch the morbid tissues as much, and to rupture them as little, as possible, in order to destroy, or, at all events, to greatly impair, the natural tendency of the stricture to contract. Before operating, the distance of the stricture from the external meatus is measured by passing a full-sized bougie down to the stricture; the slide is then placed upon the figure on the stem which denotes that distance. The instrument is passed until the slide arrives at the meatus, and the blades are slowly separated: when the maximum distension is reached, the screw is turned back only about half-way, so as not to close the blades; the instrument is withdrawn; a full-sized gum catheter is at once passed, and allowed to remain twenty-four hours. On the third day after the operation a large metallic sound is passed, and subsequently at longer intervals. During the past year I have thus operated on several cases, and with the happiest results.

To return to the subject of gradual dilatation, and particularly to its employment for old and irritable strictures: in such cases, especially when occurring in enfeebled constitutions, it is necessary to proceed with great caution. More progress will be often made by employing those adjuvants, which a deranged state of the constitution requires, than by pertinaciously continuing the use of the bougie when the stricture is unusually obstinate; this is a maxim of the first importance. Further, having arrived at any given number in the scale, say 6 or 7, beyond which it is difficult to proceed, we may sometimes gain ground by employing half or intermediate sizes, which I have been in the habit of thus using for many years. Or we may employ the French scale, which gives 18 numbers between our numbers 1 and 12, and so admits of more gradual steps in the treatment; the number 3 of the French scale equalling our number 1, and the 20 our number 12; these have the advantage of indicating the exact calibre of the urethra through which they have passed, the number of each indicating so many millimetres of circumference.

There are some cases unquestionably in which, however much of pains and care, of adjuvants local and general, have been expended, the patient's existence is barely a tolerable one. The urethra and bladder are so sensitive, or the stricture is so contractile, that exquisite suffering from instrumental interference, and fever, or retention of urine constant or constantly impending, are the alternations presented. These facts, recognised by all Surgeons of experience, have led to proposals to treat the malady by many other methods. The next to be considered is the treatment by caustic agents.

1. *Caustics.* During three centuries at least, escharotic substances have been employed by Surgeons for the purpose of destroying the obstructions in earlier times supposed to be "callus" or "caruncle," which oppose the passage of the urine. With this view, savine, antimony, mercury, verdigris, quick-lime, vitriol, alum, and other active agents, have been carried by some contrivance or another down to the urethra. John Hunter, in the latter part of last century, brought into note the nitrate of silver; and Mr. Whateley, in the commencement of the present century, the caustic potash. These substances have been supposed by their advocates to act, first, by deadening sensibility, and thus allaying spasm; secondly, by causing to slough, and so destroying, the morbid tissue of the stricture itself; and lastly, by dissolving or softening that tissue, and thus permitting instruments to be passed. A very considerable experience has been obtained by some English and many French Surgeons, the result of which is, that the prac-

ice of applying chemical agents has been for some considerable time steadily diminishing in the hands of the best Surgeons. It has been very generally doubted, if it be possible to limit the application of any soluble substance possessing the active qualities of those two agents, especially those of the potassa fusa, to any given portion of the urethra, particularly in those cases which are complicated with false passages, and which furnish by far the most difficult examples which the Surgeon is called upon to treat. Their use also is by no means free from painful and even dangerous results, such as violent spasm, retention, and fever. Moreover, there is reason to believe that these caustics exert an action upon the urethra similar to that which follows their application on other parts of the human body, and liable to be followed by increased induration, and the formation of fresh contractile tissue. On the other hand, the advocates of potassa fusa especially claim, that after its use the catheter is more easily passed; and, that in cases in which they have been unable to pass any instrument at all, this agent has frequently been successful: while numerous results of this kind may, they say, be referred to. Now, it may fairly be granted as probable, that a certain present advantage may be gained by the method in question, and that in this manner it may in some hands be undoubtedly useful; the remoter effects, however, already alluded to, should not be lost sight of; nor should the very important consideration, that by patience, care, and gentle management, there are very few cases indeed in which a catheter of some kind cannot be introduced fairly through the stricture into the bladder; a result far more desirable than any which is only accomplished by means of caustic applications. The conviction gains ground, both here and abroad, that those cases, which have been called "impermeable," in relation to catheterism, should very rarely be considered so. Perhaps the opinions and practice of the profession abroad, in reference to caustics, cannot be more truly or concisely represented than in the recent words of Nélaton, who states that "cauterisation of any kind is rarely employed now, on account of its uncertainty and the tumefaction of the urethra and retention of urine which it produces, and the new formation of contractile tissue which is likely to result."* In like manner, the widely received opinion in England is thus expressed by Mr. Erichsen: "This practice, stigmatised by Mr. Liston as 'most atrocious,' has now but few advocates; and, indeed, there appears to be nothing that it effects but what can be accomplished much more safely and easily by a catheter or sound in an ordinarily skilful hand."† It may be added, that my own observation and experience lead me fully to coincide with these able Surgeons.

Under such circumstances, little need be said here as to the method of employing these agents. It suffices to state, that the nitrate of silver may be applied by passing a small stilet, on which the salt has been fused, by means of a hollow canula down to the stricture, with which the agent is permitted to remain in contact for a few seconds. The potassa fusa is ordinarily employed by carefully attaching a small fragment, such as the fourth or the half of a grain, to the end of a wax bougie, and then passing it down and pressing it for a moment or two against that structure, whatever it may chance to be, which stops the instrument in its progress along the urethra.‡

2. *Incisions.* Under this somewhat comprehensive term are included numerous modes of dividing the morbid structure which surrounds and narrows the urethra. All may be arranged in two classes: the first contains operations, in which the incision is made altogether within the urethra; the second, those in which incisions commence from without, usually in the perineum, and are carried into the urethra and through the seat of stricture.

The first, or internal urethrotomy, will now be considered. This method of

* *Elémens de Path. Chir.* Paris, 1858, tom. v. p. 409.

† *Science and Art of Surgery*, 2d ed. Lond. 1857, p. 925.

‡ Further information on this subject, if required, may be found in the works of B. Phillips, who first advocated and subsequently repudiated the employment of caustic; of Dr. Jas. Arnott, Mr. Wade, and Mr. H. Smith.

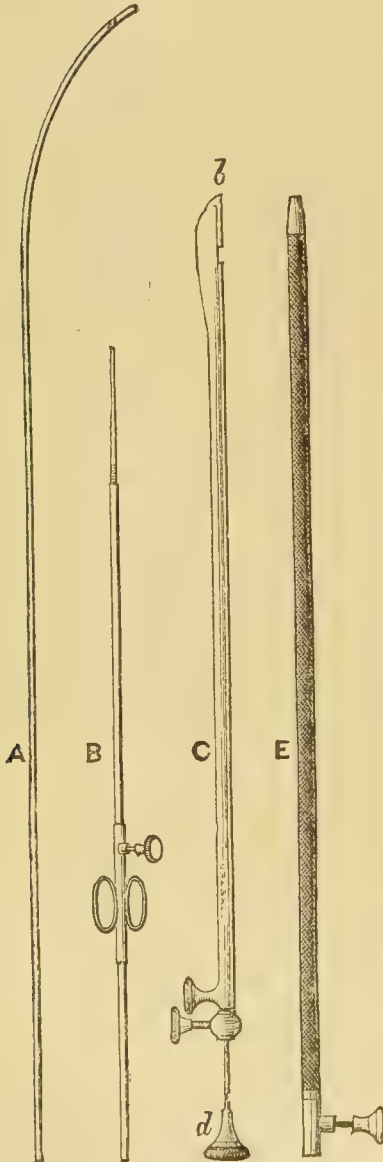
dealing with obstinate stricture has been practised for above a century. Long before that time, internal incisions had been combined with the use of escharotics, although it does not appear that they were employed alone much before the period named. Allies of France (1755), Physick of Philadelphia (1795), John Bell (1806), Charles Bell (1807), M'Ghie (1823), and Stafford (1827), have

employed different instruments and different modes of performing internal incision. Modified forms of some of these have been occasionally adopted by modern Surgeons in this country; but the method has been practised much more extensively in France, where very numerous forms of urethrotome have been designed.

All belong to one of two classes: in the first, section is made by pushing downwards a lancet-like blade, generally with a slender conductor in advance of it, into the obstruction to be divided—incision from before backwards. In the second, a portion of the instrument containing a small blade, sheathed, is first carried through the stricture, which is divided by protruding the blade and drawing it outwards through the whole of the contracted portion—incision from behind forwards.

Incision from before backwards. Whenever this mode is practised, a guide should previously be passed through the stricture into the bladder, to insure an accurate course for the blade: formerly incisions were made without any guide; a method now wholly discountenanced, on account of its uncertainty and danger. This proceeding has usually been considered more applicable to obstinate strictures which are situated within three or four inches of the external meatus, provided they are not greatly indurated, than to those which are more deeply placed, although it is quite possible, especially with modern instruments, to employ it for these also. It has not been greatly used in this country, but has of late come more into vogue abroad, from the recent employment of a fine flexible guide, which precedes the urethrotome in its passage through the stricture and is then pushed onwards into the bladder. The practical value of this method cannot be endorsed here: a better one, with a grooved guide, has been employed by Mr. Wood of King's College Hospital; and more lately a "catheter urethrotome" has been designed by the present writer, "the peculiarity of which is, that every step of the process is mechanically certain and safe, after a No. 2 silver catheter has been passed." The catheter having withdrawn the urine, and thus proved that the instrument is not in a false passage, the blade slides along it through the stricture, is then withdrawn, and a large gum catheter is passed over the small silver

Fig. 4.



A, silver catheter, size of No. 2, by which the urine is withdrawn. B is a rod of the same size, which screws into the end of the catheter. C is the urethrotome: *b* the blade sheathed; *d* the handle which unsheathes it. This instrument passes down a groove in A, and, after incising the stricture, is withdrawn; when E, a gum-elastic catheter, is passed into the bladder over the catheter and rod, AB.

theter, which, being also withdrawn, concludes the operation (see fig. 4). This remains for twenty-four hours; and the subsequent treatment is the same as at described in the next section.

Incision from behind forwards. This mode of operating is for the most part more certain and effective than the preceding; and it is applicable equally to all parts of the canal. It requires generally, however, that the stricture should be dilated sufficiently beforehand to admit that part of the urethrotome which contains the blade to pass through and beyond, before the incision can be made; and this portion is necessarily equal in size to No. 3, 4, or 5. This preliminary dilatation is accomplished by the "continuous" process. It has often been objected, that if we can pass a No. 4 or 5 through a stricture, there can be no occasion to employ any cutting instrument at all. But such a remark is based on defective acquaintance with the subject. The indication for a cutting operation is not that the *stricture is of very small calibre, but that it is non-dilatable*; that is, that its calibre cannot be permanently increased by the most persevering and judicious application of instruments, or that so much fever and distress are produced by them as to counterbalance the benefit of any dilatation they may effect. Thus, a stricture may at the outset of treatment not admit even a No. 1 bougie, yet in a short time it may be easily dilated, and show only slight tendency to return, easily counteracted by occasionally passing an instrument; on the other hand, a stricture which habitually admits No. 6 or 7 may be the cause of the greatest suffering, of almost daily retention, and be irritated instead of benefited by all attempts to dilate. It is in such cases, happily not frequent, that incision has proved of very great service. I have rarely experienced better results from any operation than those obtained from internal urethrotomy in cases of the kind described.

Before employing any form of internal urethrotomy, it is necessary to have an accurate idea of the site and extent of the stricture to be divided; this is obtained by employing on two or three occasions a sound with a bulbous extremity, just large enough to pass through the contracted part (page 394).

I have employed by choice the urethrotome of Civiale.* In this instrument the blade lies concealed in the bulbous extremity, from which, by means of a simple contrivance in the upper end of the sheath or canula, it can be made to project one, two, three, or four degrees, according to the depth of the incision intended (see fig. 5). The mode of proceeding is as follows: having sufficiently dilated the stricture, so that it will admit about a No. 4 or 5 bougie, the situation and extent of the obstruction are ascertained by means of the urethrotome itself, the bulbous end of which forms a useful sound. The bulb is then carried about one-third of an inch, or a little more, beyond the stricture, the blade projected, and the incision made by drawing it slowly but firmly outwards—that is, in a direction towards the external meatus—to the distance of an inch and a half or two inches, generally towards the floor of the urethra, so as to incise fully the stricture and a little of the sound urethra before and behind it. Experience shows that hazard is not increased by the length of the incision, which should always be fully adequate to the purpose; but it is quite otherwise in the important particular of depth: this should never exceed the amount

Fig. 5.



Civiale's urethrotome.

* Various other methods and instruments have been devised, by Amussat, Leroy, Etiolles, Scdillot, Maisonneuve, Ricord, Mercier, Reybard, Heurteloup, Bonnet, and others; but it is deemed unnecessary to refer further to them here.

produced by about half the power of projection possessed by the instrument in question. After the operation, a full-sized elastic catheter is retained for twenty-four hours. During the first fortnight, a metallic sound is passed about every second day, taking care to press the convexity of the curve well downwards into the site of the wound, so as to keep the lips asunder, or at all events to extend the cicatrix. After this it is to be used every three days, every four, every week, and at last twice a month. Hæmorrhage to any considerable extent is rare; if it is free, a full-sized instrument in the urethra, and external cold, will stop it. Febrile symptoms occasionally show themselves after the operation, as in other modes of treatment, and disappear without remedial means. In relation to the accidents which may immediately follow the operation, the following is the result in upwards of twenty cases of urethrotomy performed by myself in the manner described. In those practised for stricture situated in the urethra in front of the scrotum, I have seen no ill effects whatever. In those practised in the bulbous part of the urethra, I have twice seen free but never dangerous hæmorrhage; and sometimes a smart attack of fever, but never abscess, extravasation of urine, inflammation of the bladder or kidneys, or pyæmia. Such occurrences may occasionally be met with doubtless, because any instrumental interference with the urethra—even the passing of a bougie—is apt in certain cases, happily very few in number, to give rise to these conditions. Indeed, no one who is experienced in the surgery of the urinary organs can question that such events must sometimes arise.

In relation to the positive benefits which are to be obtained, the immediate result is perfect. Properly incised, there is no longer the slightest grasp on the largest instrument introduced, and it is often difficult to recognise the seat of the former contraction.

In some cases these results are permanent; in others, the stricture shows a tendency to return; but as in external division, so in internal, the contractility and the nondilatability—those characters which have been before shown to be the indications for resort to operative procedure—are generally greatly diminished in intensity; and if subsequent treatment be necessary, dilatation usually suffices.

Such have been the general results of urethrotomy, when properly performed, and applied to suitable cases. I think it right, however, to add here that my observation and experience of distension at a single sitting, or by rupture, have convinced me that the methods which have been practised by Mr. Holt and by myself (see pp. 398-9) will frequently supersede the necessity for internal incisions. The newer methods, however, are to a certain extent under trial; it has therefore been considered desirable to give sufficient prominence to the older operations, which have been largely practised, and which have been so useful in some of the most severe examples of the disease.

Incision is especially applicable to that not uncommon form of stricture which occurs at, or very near to, the orifice of the urethra. It may be congenital, the result of inflammation, of cicatrization after chancre, or other lesion there. It may be the only obstruction in the canal, and yet give rise to the most painful and serious symptoms, and even to a fatal result. I have repeatedly given complete relief to distressing symptoms, the cause of which was not suspected, by dividing an external meatus, which admitted nevertheless a No. 5 or 6 catheter. The incision may be performed with a director, and a straight, narrow-bladed bistoury; but the most efficient instrument is a small *bistouri caché*, which is passed through the contracted part of the canal; pressure being made on the handle, the blade is opened to an extent previously determined and arranged by means of the screw; it is then drawn out, with the edge turned towards the frænum, and the section is made. A piece of dry lint, introduced by the meatus for an inch and left there, stops the bleeding. After a day or two, the patient introduces for himself a short conical metal bougie, about three inches long, and provided with a handle sufficiently large to prevent its slipping into the urethra.

The late Mr. Colles, of Dublin, adopted a method of treating some of these cases which deserves notice. It consists in drawing over the surfaces divided by the section described the two edges of urethral mucous membrane, an

atching them to the external margins of the wound, each lip of which is thus covered by membrane, and prevented from adhering to its fellow.

External urethrotomy. The division of the tissue composing the stricture is sometimes effected by incisions commenced from the external surface. Various external operations, although designed mainly to relieve retention of urine, were made at a very early period, according to Rhazes (10th century), and Avicenna (11th century). The earliest operation for the cure of stricture apart from retention, but in which the Surgeon could pass no catheter, is recorded by Wiseman (1652). A few years afterwards, Solingen, at Livourne, adopted a similar course. François Tolet and Colet (1690) appear to have performed similar operations in France. J. A. Petit and Ledran (1740) had recourse to them also, and more frequently perhaps than their predecessors. In 1783 John Hunter performed the operation now known, and described hereafter, as the perineal section; but it was rarely employed until Mr. Grainger of Birmingham advocated it, in 1815. He was followed by Mr. Arnott: since which time it has been the proceeding ordinarily adopted for the treatment of certain extremely obstinate and complicated cases, in which the Surgeon has found himself unable to pass any instrument whatever through the stricture. More recently (1844) Mr. Syme has advocated the division of the stricture for some exceptional cases, in which, *although a catheter can be passed into the bladder*, no other treatment has afforded sufficient or permanent relief. This operation he has called "external division," a term which should be reserved for his method; while it is equally desirable to limit the use of the term "perineal section" to the proceeding just referred to in connexion with strictures which have been found impervious to the catheter.

Perineal section will be first considered. This operation, or that without a guide, and employed only for so-called "impermeable" stricture, is much less frequently performed now than it was some few years ago. There is a growing belief, which has greatly influenced practice, that few, if any, strictures exist through which, if the urine issues externally, a catheter of appropriate size may not be passed in the course of time, with care, gentleness, and skill. When absorption, however, does occur, and it is decided that the state of the patient is such as to require operative interference, the following operation may be performed. The stricture being situated in the bulbous portion of the urethra, the patient is placed on a table, in a good light, is secured as for lithotomy, and the perineum is shaved. A large catheter is to be passed as far down the urethra as the obstruction will permit, taking care that the instrument rests on the face of the stricture, and not in a false passage; an assistant holds it firmly, and draws the scrotum upward. An incision is made in the middle line of the perineum, along the raphé, from the base of the scrotum to near the margin of the anus, and the point of the catheter is to be exposed by deeper incisions. The edges of the opening are then to be held apart as widely as possible with hooks, or by some other means, so as to give a clear view of the urethra and of the contracted opening. This done, the operator, who should be provided with grooved directors of the smallest size, endeavours to carry one of them through the contraction, and if he is successful, the division may be made with ease and safety. He may not be able to pass the director more than two or three lines, until, having made a careful division so far, he may be enabled again to follow the track of the contracted canal, and to divide another portion of it upon the instrument. But if a director cannot be introduced, he must endeavour by dissection to follow the urethral canal as closely as possible. In either case, as soon as the continuity of the passage is restored, the catheter first employed is to be carried onwards into the bladder, secured in the usual manner, and retained for some days.

External division. This proceeding consists in first passing a slender grooved steel sound through the stricture into the bladder, and in cutting down from the external surface to it, so as to divide entirely the stricture; then a large catheter is tied-in for forty-eight hours, and dilatation maintained at intervals afterwards.

The following are the details to be attended to in performing the operation:

First, a clear idea of the precise situation and extent of the stricture must be formed before commencing. Next, the patient being placed as for lithotomy, a staff, the lower half of which is slender and grooved, and the upper of full size, is passed so that the shoulder or edge of the thick portion rests firmly against the face of the stricture, the slender part passing through it into the bladder. An assistant holds the staff in his right, and draws up the scrotum with the left, hand. The operator makes an incision in the line of the raphé from above downwards, about two inches long, and steadily follows the direction of the median line, through the structures intervening between the skin and the staff, until he can distinguish the shoulder of the staff, and by that is guided to the position of the stricture, when, taking a sharp straight bistoury in his right hand, and the staff itself in his left, he engages the point of the knife in the groove of the staff, about an inch below the shoulder, and cuts upwards, dividing the tissues, to the upper end of the groove. If the stricture has been properly divided, the shoulder of the staff may be passed downwards through the incised part with ease, and if so, is withdrawn, and a catheter passed in its place. Since, however, the point of a catheter sometimes catches in the wound, and does not go readily into the bladder, perhaps from the urethra occasionally collapsing at the posterior limit of the incision, I prefer to introduce by the wound, before withdrawing the staff, a concave curved director along the convexity of the staff, on which the catheter glides securely and certainly into the bladder. If the catheter, however (which should not be smaller than No. 10), be obstructed at any point, and be obviously grasped after it has been passed, it is certain that some fibres still require division, and these should be at once incised.

At the end of forty-eight hours the catheter is to be withdrawn; and generally about three days after a full-sized sound should be passed. Mr. Syme likes to guard the wound from contact with urine as much as possible, by introducing a tube from the wound to the bladder, and leaving it there, as after lithotomy; and he employs, in that situation, one with a double curve, and about nine inches long, instead of the catheter, which he dispenses with altogether at first. Subsequently the catheter is passed every three or four days for a time, then once a week, then once a fortnight, and finally once a month; and the practice may be continued if any disposition to contract appears; but if otherwise, it is necessary only to make a trial of it from time to time.

Mr. Syme lays stress upon the importance of attending to the following particulars, which I add briefly here: 1. Maintain the median line in the incisions. 2. Make a direct opening down to the staff, not a tortuous one. 3. Divide the whole of the contracted part, rather more than less. 4. Do not cut so far back as to endanger the deep fascia of the perineum, and use the knife in the deep incisions with the cutting edge uppermost. 5. Do not close the end of the inlying catheter, lest urine be forced into or through the wound, for want of patency in the instrument. 6. Avoid escape or displacement of the instrument. 7. If incisions are made far back, introduce a curved tube through the wound when the catheter is withdrawn. 8. Do not neglect dilatation during the progress of recovery.

Results of treatment by external incisions. In reference to the operation without a guide, or the perineal section, the best that can be said of it is, that it is a hazardous proceeding, and no Surgeon should entertain the idea of performing it except after thoroughly assuring himself that the stricture cannot be rendered permeable to instruments, and so made amenable to other modes of treatment. In a few cases the operation is performed successfully, but in most there can be little doubt that the route of the stricture itself is not followed, and that the knife makes a new channel through adjacent and often very unsound tissues, very inadequate to perform subsequently the function of a urethra. In many instances the attempt to make a channel to the bladder has wholly failed, and the patient has been removed from the operating-table unrelieved; and in not a few the result of the proceeding has been fatal. This termination, however, is to be anticipated in a large proportion of what must necessarily be the worst cases of their kind. Such views of this operation tend to impress us more strongly with the conviction, that every chance of getting an instrument through

the dilated urethra by protracted but gentle endeavours, combined with rest and constitutional treatment, should be exhausted, before we consent to resort to perineal section.

Respecting the operation of external division, or that performed on a grooved staff, it will be remembered that it is applicable only to cases which present either an insuperable tendency to contract after dilatation, or a condition in which bougies are incapable of dilating, or an extreme irritability on the part of the stricture, rendering any prolonged mechanical treatment futile or impossible.

These conditions are well and satisfactorily treated in some cases by internal division and by rupture; those instances, for example, in which the constricting nondilatable tissue is manifestly not considerable in quantity, and can be divided by means of an internal incision of moderate depth, or overcome by distending instruments. Where, however, the stricture consists of a large amount of morbid tissue, with much induration, perhaps involving the whole thickness of the corpus spongiosum,—a condition usually appreciable to the finger externally applied, more especially if fistulæ, either chronic or numerous, coexist,—the operation of external division is generally the most suitable for the case. It is therefore considered here as applicable only in exceptional cases; and in these, where it is properly performed, and followed by careful management, excellent results are frequently produced. I have observed such in my own practice for cases which I believe could not have been materially benefited by any other proceeding.

After a careful observation of a very large number of cases so treated, there is ground for speaking with some degree of certainty respecting the immediate and remote results of this operation. Among 219 cases, collected with scrupulous care by myself, there was a mortality of between 6 and 7 per cent. Of this percentage nearly two-thirds died of pyæmia, the remainder (one or two only excepted) from fever and suppression of urine. Such a mortality is by no means large when we consider what kind of subjects selected bad cases of stricture are, especially as they occur in hospital practice, by which most of this series was furnished.

Hæmorrhage, to a moderate but not dangerous extent, not unfrequently occurs either at or after the operation. Very rarely is it serious; and when it is, there ought not to be difficulty in stopping it. A full-sized catheter being in the urethra, it is necessary to plug the wound with lint, and maintain a firm pad of the same material over it, by means of a T-bandage closely applied. In one case in which I operated, the perineum being greatly indurated with several fistulæ, there was obstinate bleeding from vessels which the ligature would not hold, owing to the nature of the tissue in which their mouths were embedded; but I succeeded in stopping it by carrying a small curved needle beneath each bleeding point. In regard to the important question of remote results from this operation, there have been some few cases undoubtedly in which it has failed to be successful; in a much larger proportion, more or less of recontraction appears after the lapse of time. This has sometimes arisen from want of care to divide the entire contracted portion of the urethra; in other cases, from neglect of subsequent dilatation. On the other hand, in some cases, I can personally vouch for the fact that no narrowing has appeared seven years after the operation. In most, I believe, it will be always necessary, or at all events prudent, to maintain some dilatation afterwards; the condition usually obtained being a dilatable urethra, in the place of a nondilatable and obstinate stricture.

Spasmodic stricture. It is extremely rare that any considerable narrowing of the urethra takes place as the result of pure spasm of the muscles surrounding the passage. Granted, however, the presence of organic narrowing, or of inflammation in the canal, and an undue action of the urethral muscles may be excited, so as still further to narrow it. There is no doubt that a slight degree of this action may be excited in any part of the passage; but it certainly

becomes more obvious in the membranous part, where sphincteric muscles exist in addition to those unstripped fibres which surround the canal throughout the whole of its course. Nevertheless the existence of "spasm" is very constantly and very frequently affirmed, often without any proof of its presence, and usually in order to account for unsuccessful catheterism. Organic difficulties are quite sufficient without it, in many bad cases, to baffle at times the most experienced and most dexterous operator.

But spasm does often exert some influence, when the cause of irritation preëxists in the canal itself; very rarely it may do so when the cause is not there, but is situated remotely. Of the first-named fact the following are instances: the presence of organic stricture; of inflammation from repressed gonorrhœal discharge; irritation of the mucous membrane from highly acid, and occasionally from acrid, urine; from foreign matters ingested, and expelled by the urine, as cantharides, turpentine, and perhaps some forms of condiments and of alcoholic drinks; and from voluntary retention of urine exerted during too long a period of time. Examples of more remote causes of spasm are rectal irritations, as hæmorrhoids, fissure, prolapsus, fistulæ, operations in the rectum, ascarides, prurigo about the anus, derangements of the digestive apparatus and of the cerebro-spinal system. But it is important to remember that the distinguishing feature which marks the phenomena thus ascribed to irregular muscular contraction, and by which they are contrasted with those of organic stricture, is their transitory character. The symptoms of a narrowed urethra may repeatedly occur, but the canal ordinarily possesses its natural degree of patency. This is never the case in the presence of organic stricture; the stream then varies, but it never attains the natural size.

In treating spasmodic stricture, general principles must be kept in view, and applied according to the particular requirements of each case. Local treatment of the urethra itself is often of secondary importance, sometimes, indeed, prejudicial. The main thing, as in all spasmodic affections, is not to regard so much the sign or symptom itself as to investigate the cause, a correct appreciation of which is the only key to successful treatment. This must be carefully sought, not only in the urinary tract, but in adjacent and allied organs, and in the condition of the system at large. Speaking in general terms, it will be found that attention directed to the condition of the animal powers, to the improvement of the secretions, and to the regulation of the regimen and habits of the patient, will conduce more to the removal of the local symptoms than any measures apparently of more direct or special application.

If any degree of organic stricture coexists, it is essential to treat this in the usual way; but as far as the complication of spasm is concerned, the treatment consists in obviating all sources of derangement which can be discovered as likely to influence the condition of the local disease.

I have known a single instance of spasmodic retention to occur periodically, and to disappear before the use of quinine: Sir B. Brodie records one similar

case. A very hot hip-bath, a cupping on the perineum, or the inhalation of chloroform, may sometimes give instant relief. For the most part, however, spasmodic action in the urethra is associated with inflammation affecting a part or the whole of the canal, and especially when inducing retention of urine. Any further notice of its treatment will therefore be referred to the management of that condition. (See Retention of Urine, p. 416.)

Inflammatory stricture. As in the preceding example of spasmodic stricture, the term here employed rather designates a condition liable to affect and intensify a preëxisting organic stricture, than a separate and independent lesion. Retention of urine is undoubtedly caused by inflammation of the urethra; but this is by no means inflammatory stricture in any sense in which the term can be logically employed; the pathological condition usually present in such cases is acute inflammation of the prostate, with swelling of that gland (see p. 362). Nevertheless the term has been so generally accepted to describe an attack of painful and difficult micturition resulting from inflammation attacking a urethra already affected with some organic constriction, that for the present it seems desirable still to employ it. The patient complains of heat, fulness, and tenderness in the perineum; the passing of the urine is exquisitely painful; the stream narrows rapidly during the act of passing it, and ceases before the bladder is emptied or the desire diminishes. Usually it is found on inquiry that a recent purulent discharge from the urethra has been suddenly checked by external cold or wet; the signs of inflammatory fever are usually present. As this condition almost invariably comes under the Surgeon's notice for relief of retention of urine, the subject of treatment will be considered in the section devoted to that condition resulting from acute prostatitis.

Tumours in the urethra. The cause of urinary obstruction was formerly supposed, in nearly all cases, to be the existence of "carcinomata" or "caruncles" growing from the mucous membrane of the urethra. Such bodies do exist, but they are excessively rare.

Pascal (1718) describes two cases of numerous small fungoid excrescences obstructing the urethra. Morgagni (1761), in his forty-second letter, speaks of one which he had seen among many examinations. Arnaud (1769) names three instances. Hunter met with two cases; one is in the Museum of the Royal College of Surgeons. Sir Charles Bell describes and figures two cases. Amussat, Civiale, Lallemand, Ricord, Chelius, Leroy, and Mercier, all describe occasional cases met with in their own individual experiences. Guthrie and others in this country have met with a case occasionally. A good specimen exists in the Museum of Guy's Hospi-

tal of polypoid growth springing from the mucous membrane of the membranous portion. I have myself met with a good example of small polypus springing from the verumontanum, in a man, aged 54 years, a patient in the St. Marylebone Infirmary. The only sign of its existence, which could be ascertained during life, was an increased frequency of micturition. Those which are found at the anterior part of the canal, and which appear almost confined, as regards situation, to the fossa navicularis, are usually soft, of a rose-red colour, bleed very readily, and are not very sensitive. Their close proximity to the erectile tissues beneath may be reasonably supposed to be the cause of their peculiar vascularity. That they are, but more rarely, to be found in the posterior parts of the canal, is proved by some of the preparations referred to. On the other hand, almost all the specimens of the polypoid growths which I have seen are confined to the prostatic portion, and are sometimes accompanied by others at the neck of the bladder or within it, to which latter, indeed, they then have the appearance of being secondary formations, and they are more frequently found affecting only the lining of the bladder, and not that of the urethra at all. In such cases their structure amounts to little more than hypertrophy of the mucous membrane.

The conclusions to be drawn from the facts known respecting growths into the urethral canal are :

First, that the existence of any excrescence so large as to attract observation as an independent growth in the urethra is extremely rare.

Secondly, that these bodies consist either of (a) *vascular granulations*; (b) *polypoid formations* peculiar to the prostatic part of the urethra; or (c) masses of *tubercular* and *cancerous* origin.

Lastly, that tubercular and cancerous deposits are rarely primary in the urethra, but are mostly secondary to disease of the kidney, bladder, or prostate, and rarely appear until the primary disease has been developed to a formidable extent elsewhere.

Urinary abscess—most frequently a result of obstruction in the urethral canal—may be regarded in reference to its situation as penial or ante-scrotal, scrotal, perineal, and intra-pelvic. Among these the perineal is the most common, next comes the scrotal; the intra-pelvic occurs usually in very advanced cases of stricture, &c., in which a fatal result is impending, and also as a consequence of operations; and the penial is rare, most frequently being caused by gonorrhoeal inflammation of the urethra.

Occasionally, but by no means commonly, urinary abscess in

the perineum may be met with, when there is no obstruction in any part of the urethra. When this is the case, there is some ground for suspecting that disease exists at or near the neck of the bladder, particularly disease of the prostate. In chronic suppurative disease of that organ, perineal abscess sometimes appears.

Ordinary urinary abscess in the perineum may be acute or chronic: the former usually requires prompt interference on the part of the Surgeon, and its presence is often indicated by constitutional symptoms before local evidence appears of a marked character. If these are severe, and there are also tension, fulness, and tenderness in the perineum, a free and deep incision made in the middle line will often give instant relief; and if matter is not seen at once, such a proceeding will do no harm, although nothing else result but a little bleeding, and the relief of tension. No considerable hæmorrhage need be feared, although sometimes, when there has been much inflammation in the part, a smartish trickling may continue for some little time. When it has ceased, a poultice should be applied to the wound. Great improvement in the patient's condition often takes place almost immediately; the fever subsides, and complete recovery may follow in a very short time.

The importance of speedily evacuating such collections of matter, even at the commencement of their formation, cannot be overrated. Matter pent up behind the deep perineal fascia which forms a partition too dense to be penetrated by the action of absorption, will find its way into the cellular tissue of the pelvis, by the side of the bladder, between it and the rectum, and give rise to dangerous consequences, or, in event of recovery, to urethro-rectal or vesico-rectal fistulæ. Otherwise it may burst into the urethra, and be discharged by the external meatus. The collection having been opened, pus in some quantity escapes, usually alone, sometimes mixed with urine, but not necessarily so. One of the main objects in making an early opening into a collection of matter in the perineum, is to prevent the occurrence of any lesion of the urethral walls; if its evacuation be soon and fully insured, we may hope to find the cavity gradually closing, and that no urine will penetrate it, when there will be less fear of its remaining long open, or of its becoming an abnormal passage for the urine.

In the case of chronic abscess, it is desirable that an incision should be made when the presence of matter is perfectly evident. These abscesses are usually situated in the neighbourhood of the bulbous portion of the urethra, and appear in the perineum and scrotum; sometimes as the result of a little ulceration behind the stricture, and escape of a drop or two of urine into the cellular tissue; oftener, perhaps, from the adjacent irritation, without having any direct communication at first with the urethra. This communication almost invariably takes place if the abscess breaks of itself, sometimes when it is opened by the lancet; but generally no urine appears when it is opened early, until some days after the operation, and occasionally not at all. An unnatural opening, however, having been established, the frequent passage of the urine through it, which must occur at each act of micturition if the stricture be narrow, prevents its closure. This artificial canal, usually termed urinary fistula, is one of the common accompaniments of neglected stricture, and often forms a troublesome complication.

Urinary fistulæ. The external openings of these passages are most commonly seen in the perineum and scrotum, which are traversed by them in various, and often by circuitous, routes; less frequently they are observed in the groins, the upper part of the thighs, the adjacent part of the nates, or even above the pubic symphysis. In the last-named situation, the devious channel usually results from incisions made to relieve extravasation; but in the scrotum or perineum it is generally due to a previously-existing urinary abscess.

Under the term 'urinary fistulæ' all these conditions are commonly included; some of them simple, and easily amenable to treatment; others complicated, and requiring much care and time in order to attain a successful result. Some are merely narrow channels through nearly healthy parts; others pass through structures indurated and deformed by repeated deposits of plastic matter, and sometimes connected with cavities secreting pus, and detaining in their interior some quantity of the urinary secretion. The external orifices of the fistulous passage may be few or numerous; in the latter case being the outlets of sinuous channels springing from the original track, and giving exit to a number of small streams when the act of micturition is performed. And lastly, besides the foregoing, there are those openings into the urethra which have their origin in loss of substance by sloughing from extravasation, phagedænic ulceration, or violent injury to the parts; and these abnormal conditions are distinct in their nature from the two preceding classes. This mode of arranging the numerous and widely-differing lesions comprehended under the general term urinary fistulæ, indicates three forms of morbid condition, each requiring appropriate treatment.

1. *Simple fistulæ.* The first class embraces those cases where, in connexion with stricture of the urethra, one or more fistulous passages exist, the surrounding parts being not much altered from their natural or healthy condition. These openings are the result of nature's mode of affording relief in cases of narrow stricture; they act as safety-valves to the pressure exerted upon important organs behind the obstruction. Thus we often see patients enjoying fair health and comfort, notwithstanding large fistulous passages in the perineum, by which all their urine is passed. But the annoyance, sometimes the pain, besides the tendency to grow worse, which accompany urinary fistula, to say nothing of considerations arising in relation to the sexual function, demand the interference of the Surgeon to bring about a natural state of things.

For these cases, as a rule, nothing else is required than to dilate fully the urethra. The urine will flow by the natural channel, and the fistulæ will heal of themselves, if we insure a free passage from the bladder. Those patients who form the exceptional instances to this rule are for the most part weak in constitution, have little reparative power, or are subjects of some chronic disease in addition to stricture of the urethra. The management of these is mostly that of the next class.

2. Cases in which the fistulæ pass through tissues indurated and deformed by inflammatory exudation.

In these cases also, the primary object is to dilate adequately the stricture, and to observe the effect induced. In some of them it is sufficient to enable the fistulous passages to heal slowly. Dilatation, however, having been maintained for some time, and little or no benefit having resulted, it will be desirable either to stimulate the walls of the fistulæ themselves, and so bring about adhesion of opposing surfaces; or to lay them open, in order to produce recent and healthy wounds, so that they may heal up soundly from the bottom. At the same time we must attend closely to the patient's general health, seeking to maintain the secretions in a natural condition. Various agents have been employed to stimulate the indolent fistulæ; one of the best is the concentrated tincture of cantharides, applied on a camel's-hair brush, or with a fine syringe. Solutions of the sulphate of zinc or copper, and of the nitrate of silver, injected by the syringe, sometimes give good results. An excellent mode is to introduce carefully, as far as possible, a small and flexible silver probe, coated with nitrate of silver; a plain probe having been introduced beforehand as a guide to the length and direction of the passage. It often happens that the external orifice of the sinus is smaller than any other part: in such a case, a little caustic potash should be applied for the purpose of enlarging it, and so permitting free removal of the discharge.

The application of compression to the fistulæ has been tried several times, and success has been claimed for it in two or three cases; in one of which, all ordinary means having failed, a cure was obtained by making the patient apply firmly to the perineum an india-rubber ball, inflated with air, on every occasion before making water, and for some minutes afterwards. This plan was studiously followed during fifteen days, when the opening had soundly cicatrised. Four months after, the patient was perfectly well.

The cure of obstinate urinary fistula has also been attempted by introducing a catheter, and permitting it to remain in the urethra for days together, on the principle of insuring, as it has been supposed, the passage of the urine through the instrument, and thus preserving from irritation the fistulous passages. Little, however, is thus gained; for experience shows, that however large the instrument may be, and however closely it may fit the urethra at the present moment, before thirty-six hours have elapsed it will lie loosely in the canal, and urine will pass by its side. It is not possible, indeed, to remove urine from the bladder for any lengthened period by this means without inducing suppuration in the urethra, which is a bar to success.

It is better to withdraw all the patient's urine, by introducing a catheter three or four times a day, or more frequently if necessary. When the patient can do this cleverly for himself, and thus insure, at every want to pass urine during a period of several weeks, that it is carefully removed without contact with the urethra, a most successful result may be hoped for. I have had an instance of this under my own care, where, a large portion of the floor of the urethra being lost, the opening closed after three or four months' attention to this practice.

Free incisions through the fistulæ, down to their origin in the urethra, or nearly so, have been found successful in inducing a healthy process of granulation from the bottom of the wound, and thus in ultimately closing the unnatural passages; provided always, however, that there is no obstruction to the free egress of the urine by the urethra, otherwise no such measure can be of any

service. In some cases in which external division of the stricture on a grooved staff is indicated, this operation may be performed in such a manner as to include the fistulous opening in the incision, in which case a successful result may generally be reckoned on. Old chronic perineal fistulæ are sometimes better dealt with by the galvanic cautery than by any other method. Another obstinate species of fistulous passage, communicating with the prostatic urethra, sometimes follows the operation of lithotomy; this also may be often successfully treated by the introduction of an iron wire heated to intensity; the best means of effecting which is undoubtedly the galvanic current, since it maintains as well as produces the required temperature.

A fistulous passage is sometimes prevented from closing by the presence of a small calculus in some part of its course. It may be a small concretion which has escaped from the bladder, or a deposit from unhealthy urine while passing through the sinus. Sometimes it occurs in fistula connected with diseased prostate, or with a prostate which is the subject of calculous formations. Fistula associated with the prostate may, however, exist in the absence of any of these causes; such as those which are sometimes connected with prostatic abscess, and which are generally exceedingly obstinate and irremediable.

Fistula is not necessarily a continuous passage from the urethra to the surface; opening from the urethra at one end, it may have a blind or cæcal extremity: hence "blind urinary fistula" has been described. A small tumour, originally formed by a collection of matter, and having a communication with the urethra, constitutes the general form. Its origin has been variously accounted for; some believing it a result of stricture, others of inflammation of the mucous follicles of the urethra. Until the tumour is opened externally, it will not disappear, when it becomes a fistula of the ordinary kind, requiring treatment already indicated.

Urethro-rectal fistulæ sometimes occur as a consequence of stricture or abscess, and more rarely, perhaps, vesico-rectal. In either case their existence is usually first announced by the passage of liquid in an unusual manner and quantity by the anus; sometimes by the appearance of feculent matter in the urine or by the urethra.

I have recently treated a case of urethro-rectal fistula in a gentleman of about twenty years of age, in whom it resulted from acute prostatic abscess following gonorrhœa. The urine passed freely by the anus for some weeks: after trying various means, the use of the catheter, &c., without success, I discovered that by placing him flat on his face during the action of micturition, almost all the urine passed by the urethra. This plan was uniformly adopted for three months. Urine ceased to pass altogether by rectum in a month, and in two more he could pass it in the upright position without any escape. The fistula has remained soundly healed ever since. If such a plan does not succeed, the actual cautery, and particularly that heated by the galvanic current, affords the best chance of success. It may be applied through the rectum; a speculum having been first introduced, and a full-sized sound carried into the bladder. On the day

before the operation the bowels are to be freely purged, and cleared by an enema an hour or two before the application of the cautery, after which they must be prevented from acting for two or three days. The cautery is to be re-applied two or three times if necessary. If the opening is large, the edges should be pared and brought together by silver sutures, after the method of Dr. Marion Sims.

The third class of urinary fistulæ comprehends those unnatural openings into the urethra depending upon actual destruction of substance from the walls of the urethra and superjacent parts. The common causes of these are, sloughing from extravasation of urine, simple and phagedænic ulceration, and mechanical injuries of various kinds. They are for the most part larger, although not invariably so, than any of those already referred to. Generally a portion of the floor of the urethra is destroyed, as well as the structures which have intervened between it and the external surface; so that in many cases more or less of the mucous membrane of the upper aspect of the canal is visible from the outer orifice. As a consequence, the whole, or nearly the whole, of the urine passes by the artificial channel in a full stream. Such apertures may be found before the scrotum, and are called ante-scrotal or urethro-penal fistulæ; or in or behind the scrotum, known simply as scrotal and perineal fistulæ.

A broad distinction exists between these two classes in relation to their amenability to treatment, and to the nature of the operations necessary to their cure. Ante-scrotal urethral openings are the most difficult to close, since the coverings of the urethra here possess but little substance. And further, owing to the extreme mobility of the member, and its liability to erection, it is difficult to maintain that perfect steadiness of position so desirable in a part which is the subject of an autoplasmic operation. Nevertheless, with all these difficulties, in addition to that formidable one the contact of urine, such openings, even when large, are not to be regarded as beyond the reach of surgical skill. The exercise of considerable patience, and of unremitting attention during a long period, is indispensable both to the Surgeon and to the patient in a case of penile fistula requiring a plastic procedure for its cure.

Openings in the perineum involving loss of substance, although by no means easy to close, are remediable with less difficulty, on account of the absence of conditions just adverted to as the obstacles in ante-scrotal fistulæ.

Treatment. Ante-scrotal fistulous openings which are of small size, but obviously depending upon loss of substance in some degree, have been closed by repeated applications of a caustic agent to their edges and to the surrounding parts. Of these the nitric acid, the nitrate of silver, or the strong tincture of cantharides, have been successfully employed in very small openings.

Dieffenbach used the cantharides, and sometimes combined with it what he called "the lace suture." This he describes as applicable to small fistulæ in the anterior part of the canal. The margin of the fistula and the surrounding skin must be frequently touched during the day previous to the operation with the strong tincture of cantharides. Before using the suture, the loose epidermis is to be removed by scraping, and a sound introduced into the urethra beyond the opening. The operator is then to take "a small curved needle, sharp at the point, but not at its edges, with a stout silk waxed thread, and by means of a needle-holder to introduce it beneath the skin at about three lines from the border of the fistula." The point of the needle is to be carried deeply, but not into the urethra, and made to emerge at another point, about three lines from the margin of the fistulous opening. By three or four of these stitches, the thread is to be carried round the opening, until it finally emerges at the point at which the needle was originally entered. The thread is embedded in the cellular tissue around the fistula, at about three or four lines' distance from it. Its ends are now to be drawn together slowly, so as gradually to approximate the borders of the fistulous orifice until it is obliterated, and then to be fastened by a knot. In three or four days the ligature may be divided and drawn away. Most commonly, however, some plastic operation is necessary for these openings. The proceedings of Cooper and Earle, the first on record, are the basis of many various proceedings since employed. Space does not admit of the necessary description here. Two of the modes employed for ante-scrotal opening are described in the present work at vol. iii. p. 128: I have given others in the 2d edition of my own work on Stricture and Perineal Fistulæ in some detail.

Retention of urine. By this term is generally understood a condition in which the patient is unable to pass any urine whatever, or only an extremely small quantity; and is in danger of serious consequences if not relieved at no distant period. Urine may be, and often is, habitually retained in the bladder, while the patient nevertheless passes as much in the twenty-four hours as the kidneys furnish, the reservoir remaining more or less filled. This is engorgement of the bladder, and is not retention, which term is held to indicate an acute and not a chronic condition.

Retention of urine may be caused by simple prostatitis, usually occurring in young and middle-aged subjects; by stricture of the urethra, usually in middle life; and by hypertrophied prostate, in elderly persons only.

The consideration of the first and second forms will come next in order here.

Complete retention. When any degree of organic stricture exists, however slight, retention of urine is always possible if exposure to the influences of certain exciting causes takes place. Occlusion of the passage may be caused by inflammatory engorgement, or unwonted muscular contraction; more frequently, perhaps, by a combination of both. Sometimes it may be caused by a foreign body, as a small calculus, a portion of a membrane, or the like, obstructing the stricture; and this is probably the rarest form.

In treating retention, the catheter is the first, and often the only means required in nine cases out of ten. The first point to be ascertained is, is it a case

of merely temporary obstruction from inflammation following gonorrhœa, or does it depend on organic stricture of some standing? The next points are the duration of the attack and the condition of the bladder, bearing in mind that while some may exhibit distension of that viscus almost to the umbilicus, the subject of an old stricture may be in a state of greater danger, although no distension is perceptible above the pubes, owing to the contracted condition of the bladder, which has become natural to him. The treatment varies somewhat in the two cases just briefly described. In the first case, or that of temporary inflammatory obstruction, it has been recommended to employ baths, opium, and depletion before using the catheter; and relief may certainly be afforded in this manner, although at the expense of prolonged suffering to the patient. The object of this plan is to avoid injury to the urethra in its inflamed condition; and if the Surgeon is not gentle, or is not skilled in the use of the catheter, it is probably the safest course to follow. But if he employs a light and careful hand, a catheter of rather small size, say No. 4 or 5, of gum-elastic or silver, the former producing less pain, should be at once passed into the bladder; and in these cases this is generally easily accomplished, if the flexible instrument retains a good curve after the stilet is withdrawn. If the Surgeon does not succeed in passing an instrument, the patient should be put into a hot bath 100° to 103° or 104° , to relax spasm and relieve internal congestion; a full dose of opium should be given by the mouth; and if there is much straining, an enema or suppository containing opium may be also administered with advantage.

If there is much inflammation about the parts, as shown by a swollen penis, urethral discharge, and tender perineum, cupping or a dozen leeches on the latter region are decidedly useful, in the event of retention persisting; generally, however, some relief follows the use of the bath and the opium, which latter may be repeated two or three times, to insure its full action on the system. There are very few cases among those here regarded as inflammatory or spasmodic that will not yield; sometimes slowly without further catheterism, sometimes by means of an instrument, which may often be passed with comparative ease after the treatment described.

There are some instances where the difficulty seems more spasmodic than inflammatory, in which repeated doses of the tinct. ferri sesquichl.; that is to say 15 or 20 minims every quarter of an hour, administered four or six times, relieve the retention. When, on the other hand, we have to deal with retention resulting from confirmed organic stricture, it is better at once to examine the urethra in the usual way, that is, with a full-sized instrument; and, having ascertained the locality of the obstruction, patiently to devote a long time to the careful use of the smallest catheters, silver and gum. In relation to its management, see pp. 396, 397, on Catheterism in difficult cases. If this proves unsuccessful, the hot bath must be resorted to; and after faintness has been induced, the catheter may be again employed while the patient is still in the bath.

Further treatment, if necessary, must depend upon the condition of the patient. Generally, opium should be given by enema and by mouth, after which the catheter is again to be used. The time which is to be devoted to the employment of all these means must be regulated by the judgment of the Surgeon. The condition of the patient, and a knowledge of the time during which absolute retention has existed, will enable him to decide the question of affording relief by some other measures. Chloroform is an agent of great value in obstinate retention. It relaxes the muscles; by causing insensibility it overcomes involuntary resistance and straining, and thus enables the Surgeon to use the catheter with greater advantage, although not with more force than without its influence.

But supposing none of the treatment hitherto employed has been successful, that the patient's condition is urgent, the next proceeding is to afford relief by making an artificial opening either into the bladder or the urethra.

To effect this, the following operations are employed:

The stricture may be "forced;" or, the urethra may be opened at or behind

the stricture; and the bladder may be punctured, either by the rectum, above the pubes, or through the pubic symphysis.

1. The first method, or "forcing" a stricture, is rarely performed now with deliberate intention. It consists in driving a catheter of moderate size forcibly through the obstacles which oppose its course, in the direction of the bladder, which when reached is evacuated, and the instrument is tied in. I have seen it successful in old, hard strictures. But it is not a proceeding which can be recommended in competition with those less harsh and dangerous proceedings which are generally practised by modern Surgeons.

2. The urethra may be opened, first, by a dissection from the surface to the stricture, and through it, according to the method already described as perineal section (p. 405); secondly, the urethra may be opened behind the stricture, the bladder relieved, and the obstruction divided subsequently. Both these are difficult operations. Especially when the perineum is thickened and indurated, it is by no means always certainly possible to dissect through the stricture from the front, or to hit the urethra behind the obstruction. The perineal section, under such circumstances, often fails to trace the narrowed channel, and sometimes even to discover the urethra at all; and a prolonged operation, with much loss of blood, not unfrequently results in failure to relieve the patient.

The method of opening the urethra by an incision made altogether behind the stricture was recommended in this country by Guthrie and Liston, but is very rarely performed, the puncture of the bladder per rectum being now generally preferred. The operation is performed by introducing the left forefinger into the rectum, to distinguish the apex of the prostate, and entering a straight sharp-pointed bistoury with the right hand just in front of the anus, so as to hit upon the urethra at the point indicated by the finger in the rectum. The knife is carried upwards exactly in the median line, so as to make an incision of one or two inches in length. In this manner the urethra is to be sought, and the stricture afterwards divided forwards or not, as the operator determines to be most desirable.

3. The bladder may be punctured in two principal ways, viz. by the rectum, and above the pubes; to which may be added a third, through the pubic symphysis. Formerly it was also punctured by a direct stab from the perineum; a dangerous proceeding, now wholly obsolete.

Puncture by the rectum is the operation most commonly adopted at the present day. Its results have been carefully studied of late years, and have been brought before the profession more prominently by Mr. Cock, who has done much to test its value. The result of his conclusions is, that it is fraught with less danger, and is more easy of performance, than any other which is adopted for the relief of retention. The objections made to it are: the liability to abscess between the rectum and the bladder; a persistent fistulous opening there; injury to the seminal vesicles, leading to suppuration of the testicle; and the danger of perforating the peritoneum with the trocar, and thus inducing inflammation of that membrane and a fatal result. The last-named, and the most serious, of these accidents is happily that which may most easily be avoided. After an examination of several cases by dissection, it is my opinion that the peritoneum is out of reach of the trocar when employed with a moderate degree of care. The puncture usually falls short of the peritoneal pouch by an inch at least. The other results do occasionally, but only rarely, occur.

The operation is thus performed: The rectum being emptied by an enema, the patient is placed in the position for lithotomy, and firmly held by two assistants. The operator then introduces the left forefinger, oiled, into the rectum, and defines the posterior margin of the prostate, beyond which the finger should be extended if possible. Fluctuation should be obtained there, from the contents of the bladder, by a tap made on the hypogastric region, unless the viscus be very contracted indeed, in which case the propriety of operating is doubtful, since the trocar may enter the opposite coat of the bladder, from absence of the requisite amount of distension. Having determined the spot at which fluctuation is most distinct, and directed an assistant to place a hand on each side of the supra-pubic region to support the bladder, a well-curved trocar, seven or eight

inches long, is carried along the finger in the middle line to the part indicated, the handle well depressed, and the point carried through the coats of the rectum and bladder, until it is felt free in the cavity of the latter. The stilet is withdrawn, and the canula retained by means of a bandage and tapes. The length of time it should be allowed to remain will depend on the amenability of the stricture to treatment. If this yields, the urine will most readily pass through the natural channel, and the opening in the rectum will readily close. Little fear need be entertained of the continuance of a fistulous opening; for on several occasions on which the canula has escaped by accident, it has been impossible to replace it, and a fresh puncture has been necessary. When it is impossible to find fluctuation by the rectum, or when the prostate is enormously enlarged, this operation, as a rule, is not to be employed.

Puncture of the bladder above the pubes is performed as follows: The patient being placed in a half-reclining position, and the pubes shaved, a vertical incision of the integument is made directly above the symphysis pubis, about an inch and a half or two inches in length at the surface; this is to be carried downwards through the linea alba, so as just to admit the tip of the finger to reach the distended bladder. Meantime an assistant, standing behind the patient, places one of his hands on either side against the abdominal walls, so as to steady the bladder. A straight or a slightly-curved trocar (if the latter, the convexity of the curve should be upwards) is then to be carried with a very little inclination downwards into the bladder. After the operation the canula should be exchanged for a silver tube, specially adapted to slide through it, secured by tapes and a T-bandage, which may remain a day or two until lymph has been effused upon the edges of the wound, when it may be withdrawn, and an elastic gum catheter worn in its place, an instrument which is generally better tolerated by the bladder than one made of metal.

The puncture through the symphysis pubis was first proposed by Dr. J. M. Brander of Jersey, in 1825, and several successful cases have since occurred in the practice of himself and others. He has usually employed a hydrocele trocar of medium size for the operation, which is thus performed: the patient should recline, and the trocar is introduced—whether after a small preliminary division of the integuments or without it, appears to be immaterial—about the centre of the symphysis reckoning from above downwards, and in a direction at about right angles to the vertical axis of the body. Dr. Brander says, “somewhat obliquely downwards and backwards towards the sacrum, varying the direction according to circumstances; a piece of flexible catheter is then to be introduced through the canula,” and retained by a tape.

In considering these methods of affording relief to the distended bladder in reference to any case which requires an operation, the question to be first solved is the following:

Are the patient's powers and condition such as to compel us to prefer the simplest method of affording immediate relief, without regard to ulterior results? Also, unless the urethra can be felt in the perineum distended with urine, which may sometimes be the case, especially if that region be not thickened or deformed, the rectal puncture of the bladder, supposing the prostate not to interfere (putting aside the puncture by the symphysis, as not yet sufficiently tested by experience to be considered on equal terms with the older operations), is generally the simplest method, as it affords instantaneous relief at the smallest possible expense to the patient's powers. But if it is probable that the canula may be required for a long period of time following the operation, I then prefer the supra-pubic method, especially if the bladder is distended, as it is inconvenient and distressing to a patient to maintain a canula in the rectum for more than a few days; whereas I have seen patients wearing with perfect comfort a tube for many years above the symphysis pubis. Again—but this is rare—if distension of the urethra is perceived in the perineum, a lancet or sharp-pointed bistoury may be carried into it, and a female catheter introduced by its side before it is withdrawn; or if the powers of the patient are good, and the condition of the parts is natural, perineal section may be employed. Having relieved the bladder, we can make a careful attempt to divide the stricture, by introducing a

fine probe from below upwards through the stricture, and passing a catheter into the bladder. If, however, induration and deformity of the perineum exist, as above indicated, the crisis of retention is not generally a favourable time for adopting this proceeding.

The treatment of retention of urine from hypertrophy of the prostate. When retention suddenly occurs in these cases, it is due to local congestion or inflammation. Hypertrophy occurs only after middle life, and develops itself slowly; and when much obstruction exists, very slight exposure to cold, or an excess in wine or in sexual excitement, may produce total retention. When this happens, catheterism is usually absolutely necessary; for although partial relief may be afforded by the measures, already described, which avail to reduce congestion, inflammation, spasm, and pain, the bladder can rarely be emptied by any other than artificial measures. If, then, the use of the hot bath and of opium has been attended with little success, we are at once to use the catheter. In these cases a well-curved gum catheter, of good size, say 9 or 10, and with or without a stilet, will often pass more easily than any other; but it should have been kept on an over-curved stilet for a considerable period of time, in order to impart to it that permanency of curvature which is generally essential to success in its employment. It is scarcely possible to overrate the value of instruments thus treated. But in the absence of such a one, and also in some cases where the prostate is unusually large, it is necessary to employ a silver prostatic catheter. This should not be less in size than No. 9 or 10; it should be from 12 to 14 inches long from the rings on the handle to the end of its beak or point; and the curved portion should comprise about a fourth to a third of a circle, which measures from $4\frac{1}{2}$ to $5\frac{1}{2}$ inches in diameter; the mean of these being, perhaps, the most generally useful size.

In passing the ordinary prostatic catheter, any difficulty met with is usually confined to that part of its course where it arrives at the neck of the bladder. In most instances its point requires to be tilted up over the tumid prostate. On this account a beaked catheter, that is, one resembling in form a lithotrite, will sometimes pass readily when the former fails. Occasionally a stout wire stilet in the gum catheter becomes of essential service by permitting us to alter materially the form of the instrument as required. Further, it enables us to put in practice a manœuvre of considerable utility, well known as having been originated by the late William Hey, of Leeds, which may be thus described: the catheter, mounted on its stilet, having been introduced as far as to the obstacle, the stilet is then withdrawn about an inch, which has the effect of increasing the curve and elevating the point of the catheter, so as often to carry it over the enlarged portion in a manner less easily accomplished in any other way.

The question occasionally arises, Is it desirable at once to evacuate the entire contents of the bladder when retention has existed for a considerable period of time? In very rare instances the removal of a large quantity of urine, amounting to several pints, especially when an upright position of the patient has been incautiously permitted, has been followed by fainting and depression, from which he has never rallied. When the extent of vesical dulness is very considerable, it is therefore prudent to afford relief in a gradual manner; and, supposing that the catheter is retained, this may easily be accomplished. The removal of some thirty or forty ounces will probably afford complete ease, and after the lapse of half an hour or an hour another portion may be withdrawn; in this manner the bladder may be gradually brought to adapt itself to the normal condition of contraction, which subsequently, as a rule, must be insured at least once or twice a day. It is not long since my evidence was required in a court of law, in a case in which death had occurred instantly after six pints of urine had been suddenly withdrawn in the upright position.

A point of importance remains. A catheter having been introduced with difficulty for the relief of retention, should it be permitted to remain? The answer must depend on circumstances. In support of the negative, if the parts are already in a state of considerable irritation, it is undesirable to permit any chances of adding to it, of which the presence of a catheter may be one. On the other hand, the bladder, after long retention, will very soon fill again, and less

hazard may be incurred by the presence of the instrument than by a repetition of the efforts to place it there, especially if great difficulty was experienced in passing it in the first instance. Greater weight usually attaches to the latter consideration, as a rule, than to the former. I have often seen great danger incurred by the too early removal of a catheter which had relieved an urgent attack of retention.

If, however, which very rarely happens, catheterism proves unsuccessful, and relief is necessary, the bladder may be punctured or the prostate perforated. For the methods of performing the former operation, see page 419. If the prostate be very large, the rectum is not so convenient a situation for the proceeding as the supra-pubic region, which is therefore generally adopted. I have punctured by rectum with the best results for retention from enlarged prostate, but then a fluctuating point was within reach of the finger, in which case it would be safe; this condition, however, is to be regarded as exceptional.

Perforation of the obstructing portion of the prostate may be performed with a strong silver catheter, about No. 9 or 10 in size, and rather longer than the ordinary catheter, but not possessing the large curve of the full prostatic instrument. The operator introduces this to the seat of obstruction, and satisfies himself by means of a finger in the rectum that it lies fairly in the urethra, and is engaged in the prostate; he then steadily carries it onward towards the cavity of the bladder, by pressing the point firmly forwards, and at the same time slowly depressing the handle; and he desists on feeling that the point is free in a cavity, and on finding that the urine flows through the instrument. This was done by Home and Brodie. Liston employed a cutting stilet "carried through a slightly-curved and long canula," and "practised the operation a few times successfully." Whatever be the instrument employed, the Surgeon is careful to maintain it in the middle line, and also to aim at making the point emerge just behind the neck of the bladder, neither too near the pubes on the one extreme, nor the posterior wall of the bladder on the other. The catheter or canula, as the case may be, should be retained not less than forty-eight hours afterwards in the bladder, that the tissues around may consolidate, and no difficulty be experienced in replacing it by a catheter when withdrawn.

Extravasation of urine from rupture of the urethra may take place during unrelieved retention of urine by the giving way of the urethra at some point; it is very rare indeed that the bladder itself is ruptured. In either case, however, mechanical distension is not the direct nor the only cause. Ulceration of the mucous membrane behind the stricture, increased by the influence of urine in almost constant contact with it, causes a breach of the urethral walls. The bladder contracting drives the urine with great force into the cellular interspaces of the superficial fascia of the scrotum and abdomen, when the rupture occurs anterior to the membranous portion, as is almost invariably the case. The situation of the swelling and inflammation is characteristic in these cases, because the course of the extravasated urine is defined and limited by the union of the superficial with the deep layers of fascia at certain points. Thus the scrotum is first gently distended; a bag, as it were, being formed by the union of the superficial and deep fasciæ across the perineum, and by their connexion with the pubic rami. As the fluid increases, it rises into the coverings of the penis and over the pubes and abdomen, but does not descend to the thighs, because in the line of

Poupart's ligament these fasciæ are similarly blended, and prevent the passage of urine beyond their junction. The consequences of this extravasation are extremely disastrous; an unhealthy inflammation results from the irritating fluid wherever it goes, and the areolar connexions of the skin and subjacent tissues are destroyed. If unrelieved, the distension becomes enormous, the scrotum sometimes attaining the size of a human head; the skin assumes a dusky red hue, or becomes purplish and livid; and gangrenous spots are sometimes apparent; not unfrequently such a one is seen on the dorsum of the penis, and is generally regarded as a very unfavourable sign, although by no means one that is necessarily fatal. The general condition of the system is one of great depression; and unless complete relief be afforded, the patient must inevitably soon succumb. He is frequently delirious, with brown tongue and extremely feeble pulse, when the extravasation is considerable.

In these circumstances it is necessary at once to make free and depending incisions into the distended parts. The scrotum especially demands a deep incision on either side the middle line, frequently the pubes, and the penis itself also. These incisions will not only free the parts from the extravasated urine, but provide for its passage from the bladder. By these openings the purulent matters, débris, and sloughs will subsequently come away, often in very large quantity. No immediate measures for the cure of the stricture are necessary, as in the present state of the patient they are neither practicable nor advisable; although it is probable that when the retention is relieved a catheter may be passed into the bladder by the urethra; however, there is no occasion to do this until the system has rallied, which it often does to a marvellous extent. In a few hours the sufferer may emerge from a state of utter prostration to one of comparative comfort and promise; the symptoms of depression and exhaustion sometimes disappearing as by a charm, unless the injury inflicted has been too extensive to admit of repair. Meantime, abundance of alcoholic stimulant and nutriment must be given to support the powers of life. Chlorate of potash, ammonia, and bark are often serviceable. Opiates are rarely necessary unless symptoms of nervous excitement appear.

However favourably the patient progresses, a considerable amount of sloughing takes place. This is commonly the case with the scrotum to a greater or less extent: both testicles are sometimes completely stripped of their covering, and are seen bare in the wound, and even hanging by the cord. During this process the removal of the products of decomposition and the cleanliness of the parts must be provided for. Antiseptic applications frequently changed, as yeast or beer-ground poultices, linseed-meal or charcoal poultices, with a few drops of the chlorides of lime or soda well stirred in, promote these indications. The use of the disinfecting chlorides, of carbolic acid, or of powdered charcoal, and free ventilation of the room, should be adopted.

If the extravasation have taken place between the two layers of the deep perineal fascia, a firm, hard, and deep-seated swelling may sometimes, but not always, be detected in the perineum. This is to be at once freely opened. If it occur behind the fascia altogether—but this is very rare—the urine finds its way upwards around the base of the bladder, and a fatal result is inevitable.

Rupture of the bladder. This accident is excessively rare except as the result of direct violence. It then usually occurs from a blow on the abdomen or from a fall, when the viscus is distended with

urine. It may be occasioned by a fragment of bone when the pelvis is fractured (see vol. ii. p. 480). When it happens as a sequence to stricture, it does so by a process of the same nature as that already described as affecting the urethra, although it may not always occur in the bladder, properly speaking, but in a thin and dilated sacculus springing from it. Occasionally the discharge of its contents takes place directly into the peritoneal cavity, more commonly into the cellular connexions of the organ below the line of its peritoneal coat, after which it may secondarily escape through the peritoneum or not. In any case a recovery has never been known to happen, and can scarcely be regarded as possible.

The symptoms of vesical rupture take place after a prolonged but not necessarily absolute retention, for some surplus of urine may have been previously escaping by the urethra. The patient usually states that he has felt something give way. Acute abdominal pain then sets in; the belly becomes exceedingly tender and distended; the features are pinched and anxious; the breathing hurried; obstinate hiccough occurs, sometimes vomiting; the pulse is sharp, quick, and irregular; the flow of urine ceases altogether, as also does the straining to void it. General fluctuation may be sometimes found in the abdomen, and inordinate distension of the bladder, before felt in the rectum beyond the prostate, has now disappeared. Sometimes the patient is delirious, and even maniacal. And after a period varying from thirty-six hours to four or five days from the time of the accident, during which the patient's agonies are extreme, death takes place.

The indications of treatment which, in the absence of experience, we should endeavour to fulfil, would be as follows: To provide for the free exit of the urine from the bladder by puncture; to alleviate suffering by large doses of opium, with hot fomentations and rubefacients to the abdomen; and to support the powers of life. Whether an attempt to remove the urine in case of extravasation into the abdominal cavity, by puncture of its walls, should ever be entertained, is an unsolved question. Such a proceeding affords the only chance (exceedingly slender as it is) of recovery which surgical aid could afford.

HENRY THOMPSON.

URINARY CALCULI AND LITHOTOMY.

OF all the ailments to which the human frame is liable, that of the formation of a stone or calculus in the kidney, bladder, or urinary passages is undoubtedly one of the most formidable and important. And on account of the tendency of this formation to become lodged in certain dilated portions of the urinary apparatus behind natural necessary narrowings, it is thereby rendered liable to increase in size, and consequently soon to become impassable and incapable of expulsion. The stone now acts as a foreign body, and irritates the delicate structure of the part in which it is retained, causing at first local disturbance and mischief, afterwards seriously involving the constitution, and ultimately leading to a miserable existence, which most frequently terminates in a lingering death.

In order to comprehend more fully the subject in all its bearings, it behoves us to take into consideration the causes and formation of stone; and in doing so we must necessarily review cursorily the circumstances which may give rise to this affection, by passing in survey the more simple and slight deviations of the urinary fluid, then its more aggravated changes from the condition of health, until we arrive at those still more complex and dangerous forms, which cause the amalgamation of the deposits into a mass, constituting a stone.

But previous to these inquiries, it is the essential duty of the Surgeon to be well acquainted with the urine in a state of health, and in its varied conditions under every circumstance. He should know its chemical constitution, its specific gravity, its amount of acidity, its variety of colour, its microscopical appearances, &c.; and not only this, but he must also bear in mind the changes which the urine undergoes during certain conditions of the body, and during certain periods of the day: thus there is the urine of the blood, passed early in the morning before any repast; the urine after the use of drinks; and the urine after the partaking of solids,—all modifying the condition of the constituents. All these points are carefully detailed in our standard chemical and physiological works, and in the numerous special monographs on the urine, to which the reader is referred.

In making a careful analysis of the constituents of the urine, we find that there are two sources from which an abnormal condition

may arise: and that an excess or deficiency of the elements from either of these sources may disturb the balance, and thus dispose to a precipitation of one or other of the constituents, causing deposits. The one source is from the organic elements, and of these urea and uric acid are the most frequent. Urea bears the proportion of 12 or 15 to 30 or 40 parts in 1000 parts of urine; it is exceedingly soluble and liable to decomposition with a development of ammonia, which is accelerated by mucus or other animal substances becoming putrid; this may take place in the urine in the bladder under certain diseased actions, and prove an abundant source for calculus. Uric acid, on the contrary, exists in very small proportions,—half a gr. to one gr. in 1000 grs. of urine; it is very insoluble in water, so that any excess of living, such as increased animal diet, will cause a ready deposition of this substance; hence the frequency of deposits and calculi of uric acid; and from this being the chief constituent of most stones, the deposit has derived the name of lithic acid. The other source is from the inorganic constituents, the salts of the urine; these comprise saline and mineral ingredients. The saline are soluble in water, and consist of sulphuric, phosphoric, and hydrochloric acids, in combination with their bases, potash and soda. The mineral salts are insoluble in water, and consist of phosphoric and occasionally carbonic acids, in combination with their bases, lime, magnesia, and sometimes alumina; traces of silica are occasionally met with. Of these salts the phosphates are the most important, as being more readily prone to be deposited.

*Urinary deposits.** These may be advantageously arranged under the foregoing two chief heads: 1. the uric acid and urate deposits, with their allies the oxalate, uric oxide, and cystic oxide varieties, derived from the organic or animal elements of the urine; and 2. the phosphates and the carbonate of lime, deposited from the inorganic elements or salts of the urine. But besides these two varieties there are other deposits to which we shall merely direct attention, without entering into a description of them, viz. the non-crystalline organic products, such as blood, pus, mucus, epithelium, spermatozoa, milk, fatty matter, &c.; and the high-coloured deposits of doubtful origin, viz. cyanourine, melanourine, indigo, Prussian blue. Two rare forms of deposit, the fibrinous and uro-stealith, will be alluded to under the head of calculi.

1. The *uric acid deposits* may be simply a yellow-pink, red, or lateritious sediment, composed of variously-formed crystals; these crystals, however, may collect into uniform masses, producing a kind of sand, of about one-fortieth to one-sixtieth of an inch in diameter, and mostly globular or oblong; again, such masses may concrete and form a diminutive kind of calculus, called gravel, attaining often the size of a pea, and capable of being passed with the urine. The crystals very commonly consist of rhombic plates, with the obtuse angles more or less rounded off, or acuminate doubly-convex lozenge-shaped plates;

* In giving a description of urinary deposits and urinary calculi, the author has availed himself of the standard works: for more minute detail reference must be made to the works of Bird, Beale, Thudichum, Bence Jones, the Catalogue of Calculi of R.C.S. England, Hassall, &c.

but the normal form is the rhombic prism. By the addition of acetic, nitric, or hydrochloric acid, uric acid may be separated from its salts in the form of rhombic tablets or six-sided prisms. Dr. E. A. Sansom* states that the form of the crystal is much affected by the strength of the acid which is added; thus, where the acid is small in quantity, the crystals are regular, mostly tables, squares, and lozenges; where the acid is in larger quantity, added to a strong solution of urate of ammonia, they consist of large and long tables, with very elongated lozenges; and where the acid is strong, and amorphous urate itself used, the crystals most frequent are acicular prisms. The causes which give rise to this deposit are described by Dr. G. Bird† to be: 1. the waste of tissues being more rapid than the supply, as in fever, rheumatism, &c.; 2. the supply of nitrogen in the food being greater than is required for the reparation of the tissues, as in over-indulgence, especially in the use of animal food; 3. the process of digestion being insufficient to assimilate an ordinary and normal supply of food, as in dyspepsia; 4. obstruction to the cutaneous outlet for nitrogenised secretions, as met with in diseases of the skin, variability of the climate, &c.; 5. congestion of the kidneys, following injury or disease of the organ. Imperfect respiration is also said to be a cause of an undue proportion of uric acid in the urine, owing to an excess of carbon and oxygen uniting with urea. The treatment to be adopted will of course be to control and remedy the cause by abstinence from over-indulgence in animal food, regular diet, exercise, free action on the skin by baths and moderate diaphoretics, mild diuretics, diluents, liberal use of good water, and so on.

2. The *urates*, generally known as the urates of ammonia, form the most frequent urinary deposits. Heintz‡ regarded these deposits as consisting of urate of soda and urate of ammonia, with traces of urates of lime and magnesia. Their colour is a pale fawn, but it may vary from snow-white, through every tint, to brick-red, pink, or purple. Dr. Bird remarks, that in the white, fawn, or brick-red deposit there is a deficient state of the cutaneous functions; whilst in the pink, crimson, or purple variety, there is more or less evidence of functional or organic derangement of the liver, spleen, or other organs influenced by the portal circulation, which is attributed by some to the presence of purpurine, and by others to the obstructed elimination of carbon, as in rheumatism, gout, and diseases of the liver or spleen. The alkaline urates generally form an amorphous deposit of minute spheres, having protruding therefrom acicular spiculæ of sharp crystals of uric acid. Some describe two forms of fawn-coloured deposit of urate of ammonia: the one, in which the precipitate mixes readily with the supernatant fluid by slight agitation, appears to form a very homogeneous mixture, and subsides exceedingly slowly by repose; the other, with frequent admixture of crystals of pure uric acid forming a pale urine, with diffusion of the deposit through the fluid in detached bran-like particles, which readily subside, and occasionally form dense clouds in the fluid, like puriform mucus, disappearing on heating; the urine is of low specific gravity. Sometimes the deposit becomes quite white, and often assumes a mucilaginous or jelly-like character.

The causes and treatment are, for the most part, those of the uric acid deposit. Open air, healthy residence, and tonics, either mineral or vegetable, are essential.

3. The *uric oxide* deposits, otherwise called xanthic oxide or xanthine, closely resemble uric acid, but the conditions of the urine depositing them are unknown. It is supposed that these depend upon an imperfect oxidation of the materials from which uric acid is eliminated by the ordinary processes of the kidney.

4. The *oxalates* are usually observed in the form of oxalate of lime, the crystals consisting of two varieties. One of these is the quadratic octahedron

* Beale *On the Urine*, p. 293.

† *On Urinary Deposits*, 5th edit. p. 159.

‡ *Lehrbuch der Zoochemie*.

class, which generally have one axis much shorter than the other two. Their varieties in shape are due to the position in which they are viewed, some even being flattened and square. The other variety is the dumb-bell-shaped crystal: this is considered by many to be formed by oxalurate of lime, and by others to consist of uric acid, both of which fallacies are explained in Dr. Beale's work, pp. 300 et seq. The dumb-bell crystals often unite into a mass, and form the nucleus of a concretion called the hemp-seed calculus. Dr. G. Bird considered these deposits to be due to an increased oxidation of the uric acid formation, and believed that they never exist in healthy urine, although their constituents are present under one form or another.* Lime is always present in the urine, combined with phosphoric and perhaps other acids; and so great is the insolubility of the oxalate of lime, and so intense the mutual affinity of its constituents, that the addition of oxalic acid as a soluble oxalate instantly determines the precipitation of the salt. The particular manner in which the evolution of the oxalic acid found in the urine occurs can scarcely be regarded as at all satisfactorily explained; most, however, seem to regard it as a secondary product of the oxidation of the saccharine matter occasionally present in the secretions, and thus appear inclined to draw a close analogy between the diathesis in which sugar and that in which oxalic acid is generated. Dr. Prout maintained that oxalic acid is one of the results of imperfect digestion, and that it is derived from vegetable food, more especially such as contains sugar. Liebig taught that it arises from the imperfect oxidation of uric acid during the metamorphosis of the living tissues; if the supply of oxygen fails to a certain extent, the products of combustion in the lungs are urea, oxalic acid, and the substance called allantoin. Dr. Owen Rees* considers that the oxalate of lime concretion is formed by the decomposition of uric acid, or of an urate in the kidneys or bladder; these are converted into oxalic acid, which unites with the lime, so that the oxalic diathesis is an accidental and unimportant modification of the uric acid diathesis.

The causes of this condition have been attributed to great nervous depression, as from grief, loss of blood, malaria; and of course the treatment will be to counteract these causes, and to pay great attention to diet and the action of the skin; as also to avoid all articles containing or liable to produce sugar, as fruits, fermenting liquors, and substances into which oxalic acid enters as a constituent; mineral acids are highly beneficial.

5. The *cystic oxide* deposits, or cystine, are considered to be modifications in which the urea and uric acid are replaced by an excessive elimination of sulphur. The deposit is described to be bulky and easily diffusible, resembling in appearance the white or pale lithates, and to consist of more or less distinct six-sided plates, variously super-imposed one upon the other, the centre portion of the crystals being somewhat opaque. Dr. G. Bird believed that it does not exist in healthy urine, and rarely in morbid; but is probably derived from the sulphur extractive matter of the urine; and he inferred that it proceeds from the waste of tissues and of the hæmato-globuline. In the majority of the sufferers the general health and nutrition have been bad. The indications for treatment are acids and tonics; such as nitro-hydrochloric acid, chalybeates, &c.

We now come to the deposits for the most part of inorganic origin:

6. The *phosphatic* deposits. The phosphatic salts in healthy urine are of two kinds, the alkaline and the earthy phosphates. The alkaline includes the phosphate of soda, the acid phosphate of soda, and the phosphates of soda and ammonia, which are perfectly soluble, and do not give rise to deposits or concretions. The earthy phosphates, viz. phosphate of lime and magnesia, occur in very small quantities, and are eliminated in a perfect state of solution, but under certain circumstances and certain morbid actions are readily deposited and form concretions. These earthy phosphates are insoluble in water, but are dissolved by mineral acids;—they are soluble in organic acids; albuminous

substances dissolve them, but the salts are again readily precipitated by ammonia. Thus the phosphatic deposits are derived from the earthy phosphates of the urine, and comprise three varieties :

1st. The *phosphate of lime*. The deposits of this salt, Dr. Bird observes, have led to more errors than any other class. Where it exists in the urine in solution, or is precipitable by heat, it has repeatedly been mistaken for albumen; and where it has formed the great mass of a deposit, has as frequently been mistaken for pus or purulent mucus. The deposits consist generally of a white amorphous matter, not in crystals, but as minute granules; after standing for some days little spherules are very frequently found. Dr. Beale says that this phosphate may also assume the form of minute dumb-bells; an appearance probably due to the adhesion of two little spherules, which afterwards become coated with a fresh deposit of the phosphate. Dr. Hassall, in the *Trans. Roy. Soc.*, Jan. 1860, where he gives a detailed account of it, states that it is more frequently found in a crystalline form in the urine than in an amorphous character. He describes the crystals as either single or aggregated, forming glomeruli or rosettes; and the more perfect crystals as having an oblique, six-sided, prismatic form.* 2d. The deposits of *ammonio-phosphate of magnesia* (the triple phosphate of magnesia and ammonia) generally assume the form of crystals of triangular prisms with truncated extremities, the terminal edges of which are sometimes bevelled off; or of four-sided prisms and irregular six-sided plates; or again, of stellate crystals, when ammonia has been added to the urine. The urine in this variety is often of a natural colour, of rather high specific gravity, and is sometimes neutral, often acid, and seldom alkaline; it evolves a pungent, disagreeable, and even fetid odour, which has been usually, but erroneously, denominated ammoniacal. 3d. The deposits consisting of a combination of the two foregoing, viz. the *phosphate of lime* and *triple phosphate*, which is also called the *mixed* or *fusible* variety of phosphates.

The causes of phosphatic deposits are generally considered to be an alkaline state of the urine, from a diminution of the requisite acidity; this alkaline condition being due to local disease, injury of the urinary organs, the presence of foreign bodies, or to general morbid conditions, such as over-exertion, vital depression, spinal disease, insufficient food, or abuse of alkalies and medicines. The source of this alkali may be an excess of carbonate of ammonia, probably effected through the medium of a ferment converting the urea into a volatile alkali. Again, mucus altered by an unhealthy condition of the mucous membrane may effect the conversion of urea into an alkali; so may also the presence of a fixed alkali, such as the phosphate of soda, produced during digestion. Dr. G. O. Rees maintains that the alkali which causes the precipitation of the phosphate is secreted by the mucous membrane of the bladder; the earthy salts are precipitated from the urine, and not secreted from the mucous membrane, as was formerly supposed. The treatment of such deposits will be the removal of all recognisable causes, such as imperfect digestion and assimilation, improving the patient's powers, and correcting the morbid conditions of the kidneys and mucous membrane of the bladder.

7. The *carbonate of lime* deposits are of rare existence, generally of secondary formation, and usually occurring in an amorphous form. Under the microscope they appear as small and delicate crystalline spherules. The deposit is stated to be the result of such a state of enervation, that the bond of affinity, which in a healthy condition of the nervous system keeps firmly united the elements of urea, becomes loosened; a rearrangement of atoms occurs, the urea becomes carbonate of ammonia, and, under the influence of ordinary chemical affinity, carbonate of lime is generated at the expense of the calcareous salts of the urine.†

Having thus taken a cursory survey of the formation of deposits due to changes in the urinary fluid, we now pass on to the more

* Hassall, *Urine in Health and Disease*, 2d edit. p. 212.

† *Guy's Hosp. Reports*, series i. vol. vii. p. 224.

aggravated conditions, viz. the amalgamation or concretion of such deposits into a mass, forming a stone or calculus. The formation of a calculus, in a practical point of view, may be attributed to one of three causes : 1st, it may take place in the secreting cells of the kidney, by precipitation of the salts, such as occurs naturally in the kidneys of reptiles and birds ; 2d, it may form in the bladder itself without renal origin, from immediate primary precipitation, in consequence of stagnation of urine in the bladder or otherwise ; and 3d, it may be produced by the presence of a foreign body in the bladder, whether introduced from without, or existing within in the shape of coagula of blood, fibrin, &c., which leads to abundant precipitation.

When once solid particles of any substance aggregate and form a mass in the bladder, they very readily induce crystallisation of uric acid, oxalate of lime, or triple-phosphate ; or a deposition of urate of ammonia, phosphate of lime, or other amorphous ingredients, according to the lesion of function, the state of irritability or innervation present, and the condition of the bladder.

The simplest mode of witnessing the early formation of a stone is in cases where a gum-elastic catheter has been allowed to remain in the bladder for some time, when, on its removal, urinary crystals and deposits are found encrusted upon it. Foreign bodies, no matter of what nature, when present in the bladder, cause decomposition of the urine, and a ready deposition of its salts upon it. Solid substances irritate and inflame the mucous membrane of the bladder, and, as Dr. Rees* observes, causes the latter to secrete a quantity of alkaline fluid, which comes in contact with the earthy phosphates, and is precipitated around the foreign body. Soft substances, on the contrary, such as mucus, fibrine, &c., do not irritate the mucous coat, but cause a precipitation of the ordinary salts of the urine around them, viz. the uric acid, urates and oxalates, and thus form stone.

Another, and by far the most frequent, cause in the formation of a vesical calculus is the escape from the kidney of a stone, which cannot pass with the urine through the urethra, and which acts in fact as a foreign body, and receives depositions on its surface. Renal calculi are for the most part composed of uric acid or urate of ammonia, less frequently of oxalate of lime, rarely of triple-phosphate of ammonia and magnesia, and, in some cases of diseased kidney, of phosphate of lime. Dr. Prout is led to believe that the uric acid calculus of the kidney is secreted by one of its mammillary processes in a semi-fluid state, that it afterwards becomes hard, the semifluid mass contracting in bulk as the hardening process continues. Others maintain that the calculus is formed by direct precipitation of the salt. If an excess of uric acid be separated by the kidneys, crystals of uric acid are thrown down ; the latter may also be derived from decomposition of the urate of ammonia—the more ordinary source.

The oxalate of lime calculus of the kidney, according to Dr. Prout's researches, is not generated in a perfectly healthy kidney, and two conditions are necessary to its formation: the first, that the oxalic acid should exist in the system, and be secreted with the urine; the second, that lime, in some shape or another (that is, the phosphate or carbonate), shall be furnished by the mucous membrane of the infundibulum. The triple-phosphate of ammonia and magnesia is rarely deposited in the kidney, but it may form a coating for the other calculi, if lodged for a considerable time in the organ. Its formation, according to Dr. Prout, takes place in the following manner: the urine, under ordinary circumstances, contains the phosphate of magnesia, which is

* Croonian Lectures, p. 23.

† Brodie *On the Urinary Organs*, p. 223.

held in solution, being a highly soluble salt. But in some cases of disease the urea of the urine becomes decomposed in the kidneys, and ammonia is evolved, which combines with the phosphate of magnesia so as to make the triple salt.

Dr. Beale* observes: "It is not uncommon to meet with microscopic uric acid calculi; aggregations consisting of uric acid crystals, which if retained might receive deposits of fresh material on the outside, until small calculi, varying in size from a mustard-seed to that of a pea, or larger, are formed. Microscopic calculi of phosphate of lime are by no means uncommon, and are often found in the kidney; but until a few years ago I had never had an opportunity of watching the formation of calculi composed of oxalate of lime. The nucleus of these calculi does not consist of mucus or epithelium, as in the phosphatic, but is of the same composition as the exterior."

The formation of a calculus in the bladder without any previous nucleus of renal origin, or the presence of a foreign body, is due either to an excess of insoluble material and the immediate precipitation of the salts of the urine,—as in the ordinary forms of uric acid, urate, and oxalate concretions,—or to stagnation of the urine in the bladder, in consequence of paralysis, hypertrophy, chronic inflammation, and catarrh of the organ, as well as diseased prostate and urethra.

Von Walther† maintains that lithogenesis is to be considered as a medium between chemical crystallisation and organic growth, and that it has always a greater disposition towards the latter. Wetzlar‡ does not consider that animal gluten is necessary for the production of stone; that urinary calculi are in no respect organic bodies. Some erroneously attribute their formation to fermentation.

The whole of the chemical constituents of a stone require to be held together by a kind of cement, which is believed to be derived from animal matter, either mucus, fibrin, or fatty matter; and some affirm that it may be blood, epithelial scales, or even pus. Mr. Coulson (in his work on *Diseases of the Bladder*, p. 343) thus sums up: Marcet referred it to the mucous secretion of the bladder; Fourcroy and Vauquelin to albumen, and sometimes to gelatine with an admixture of urea; Berzelius, however, could not determine whether it was composed of fibrin, albumen, caseous matter, or mucus; Brande considered it to consist of a mixture of gelatine with urea; Scharling holds "that the smaller calculi are always enveloped by a layer of mucus, albumen, or some other organic matter, the flocculi of which entangle, and ultimately determine the crystallisation of the more insoluble ingredients of the urine;" and Dr. Hoskins, as quoted by Gross, extends this view to the minutest particles of the concretion; he found that the pellicle of transparent animal matter enveloping the particles, when completely divested of salts, bore a great resemblance to epithelial scales; he also frequently detected in the central parts of calculi a large proportion of epithelial scales from the bladder and kidney, with fibrinous casts from the uriniferous tubes.

Urinary calculi may be arranged, like the deposits, into two distinct classes, to which a third may be added comprising the rarer forms. The first will include calculi of uric acid and the urates, with their modifications, the oxalates, uric oxide, and cystic oxide; the second, the phosphatic calculi, embracing all the varieties of phosphates; the third will consist of the rare calculi of carbonate of lime, the fibrinous, the uro-stealith, and the silicious formations. Although these constitute the essential elements of calculi, yet there are other chemical ingredients present in more or less quantities;

* *On Urinary Deposits*, 2d edit. p. 392.

† *Journal für Chirurgie*, vol. i.

‡ *Beiträge zur Kenntniss des menschlichen Harnes*, 1821.

such as organic matters, carbonate of magnesia, silica, oxide of iron, benzoate of ammonia, oxalate of ammonia, phosphate of iron, urea, clay-mica, &c.

The number of urinary calculi present varies; the renal are generally two or more, the vesical usually only one, and the prostatic very numerous: the vesical, however, may amount to 117, 242, 307, 678, and even to 1000, as stated by Dr. Physick.*

The size also is extremely variable, viz. from that of a pea, nut, or almond, to a cricket-ball; the phosphatic calculi usually attain the largest size.

The weight depends not so much upon the size as the composition of the stone, for the phosphatic are very light, and the oxalates very heavy; it may vary from a few grains to many ounces. The majority are under an ounce; the heaviest on record was 6lbs. 3ozs.† Recent calculi are heavier than old, as containing moisture.

The shape is not uniform, depending greatly upon the situation and composition of the stone; thus renal calculi are irregular, and often moulded to the form of the calyces, pelvis, and infundibulum of the kidney; those in the ureter are generally cylindrical; the vesical are more regular and of an ovoid form; the prostatic numerous, small and faceted, or pea-shaped. Again, uric acid and urate of ammonia calculi are generally smooth and regular; the oxalates tuberculated like a mulberry, hence the latter appellation; the phosphates irregular and contorted. But there are an infinite variety of forms, such as conical, pyramidal, triangular, cubical, square, rhomboidal, reniform, pisiform, cordiform, cuneiform, semi-lunar, &c. Some appear as if they had been actually divided by a firm cutting instrument; and in one case, in the Guy's Museum (no. 2136⁵⁰), the apparently divided portions seem as if they had again become cemented and framed in by a subsequent deposit. In the same collection (no. 2145³⁵) there is a cystic oxide calculus in the shape of an ear-drop. Some remarkable forms of calculi have been detailed in the Guy's Hospital Reports, series iii. vol. iii. p. 351, where the appearance resembles that of two calculi united by a transverse bar, from which circumstance they are termed bar-shot or dumb-bell shaped calculi; these are generally met with in calculi which have originated or become lodged in the prostate, and grown backwards into the bladder. Such shapes have also been found in encysted calculi of the bladder.

The colour of a calculus depends for the most part on the chemical nature of the crust or surface, but this by no means indicates

* Gibson's *Institutes*, 5th ed. vol. ii. p. 220.

† Coulson, op. cit. 5th ed. p. 337.

the actual nature of the interior of a calculus: a white surface shows a phosphatic crust; a cinder-gray, that of urate of ammonia; a yellow pale-brown, or brown, the uric acid; cinnamon-brown the uric or xanthic oxide; a brown, brownish-green, or even blackish-green, the oxalate of lime; a gray-greenish hue, the cystic oxide. These colours, however, are liable to modification, and give but presumptive evidence.

The odour of recently extracted calculi is sometimes peculiar. The phosphatic calculi are very ammoniacal, fetid, and acrid; oxalate of lime calculi on section are said to emit a faint odour of semen. Some are affirmed to possess an aromatic smell, like that of castor or musk.

The consistence depends in a measure on the chemical composition, on the amount of cohesion of the particles, and on the presence of moisture or organic matter: it varies from that of soft mortar or sand to that of hard marble. Phosphatic calculi are generally soft, the uric acid hard, and the oxalate very hard. The crust is usually the softest part of a stone, and the nucleus the most dense. A stone of rapid formation is less dense than one of long existence and of small size.

The section of a calculus shows its internal construction, and ordinarily presents a centre or nucleus, a body or intermediate part, and a crust or outside coating. When all these consist of one and the same chemical material, the calculus is called uniform or simple; when it is made up of one or more elements, the stone is termed mixed, heterogeneous, or compound. Again, these elements may be so disposed as to form a solid mass, without any visible distinction of arrangement; but generally they are deposited in concentric layers or laminae, and in some instances there are seen lines radiating from the centre to the circumference, as if the laminae were composed of perpendicular crystalline fibres. Dr. Prout* thus explains the laminated condition: "Between the different intervals at which the different laminae have been formed, periods have intervened during which no deposition has taken place. This remark not only applies to the different laminae of a heterogeneous calculus, but to the different laminae of calculi composed of the same substance; as, for instance, to the different laminae of which lithic acid concretions usually consist. This explanation is in perfect accordance with the circumstances attending the formation of calculi, which often, as is well known, remain in the bladder for a great number of years without attaining any remarkable size. Moreover,

* Prout *On Gravel, Calculus, &c.*, p. 361.

the constant state of change alone, to which the urine in all individuals is liable, almost precludes the notion of homogeneity in a calculus. We may suppose, therefore, that certain changes take place in the urine during which the law of continuity of deposition is suspended, and the surface of the concretion becomes, as it were, *water-eaten*, and less apt for future accretion; in short, assumes all the properties of a heterogeneous substance. Under these circumstances, when a tendency to deposition occurs, it will have to commence *de novo*, and, as it were, on the surface of a foreign body. The consequence will be, that the adhesion between the new and the old coats or laminæ will be less firm than in the intermediate parts, and that a calculus thus formed will be disposed, when broken, to separate into concentric laminæ."

It is not unfrequent to meet with a model calculus, viz. the nucleus formed of uric acid or urates, as urea is the chief constituent of healthy urine; the body composed of oxalate of lime, which latter Dr. G. O. Rees regards as uric acid or urates altered after secretion; and lastly, the crust formed of phosphates, the result of irritation. When a calculus consists of layers, one deposit succeeding another in a regular manner, it is called *alternating*.

For a careful analysis of the condition and relative proportion of the constituents of urinary calculi, as regards the nucleus, body, and crust, we must refer the reader to the standard works on urinary calculi, and more especially to the Catalogue of Calculi in the Museum of the Royal College of Surgeons of England, in which work also there are excellent coloured plates of all varieties of calculi. In general, calculi are classified according to the apparent nature of the nucleus; and for the present this nomenclature is adopted, although Dr. Beale* points out a fallacy when he states that it is important to bear in mind that the central part of the calculus which is visible to the unaided eye is spoken of as the nucleus, while the real nucleus may be microscopic, and of a different composition to the material which immediately surrounds it. The nucleus of many calculi, which apparently consists of uric acid, is really composed of oxalate of lime, around which the uric acid has been deposited.

The nucleus, according to Dr. G. Bird's† observations, is usually found in the geometric centre of the calculus, or nearly so; but it is occasionally remarkably eccentric, as in some reniform concretions; and in a few, several distinct nuclei, or centres of

* *On Urine and Urinary Calculi*, 1861, p. 354.

† *Guy's Hospital Reports*, series i. vol. vii. p. 182.

deposition, are met with. In some rare instances, the concretion which forms the nucleus is found loose within the body of the entire calculus; a circumstance, in all probability, arising from a layer of blood or mucus having concreted around the nucleus, and the matter forming the body of the calculus having been deposited on this layer. In this case, on the whole becoming dry, the mucus or blood would be diminished to a very thin film, and the calculus would appear to contain a loose nucleus. In a few instances calculi appear to possess no nucleus, the centre being occupied by a cavity full of stalactites or mammilated projections, giving the idea of the external layer having been first formed, and the mammilated portions subsequently in the interior. In the Museum of Guy's Hospital this state occurs only in the uric-acid calculi. In one specimen in the collection (no. 2154) the central cavity is lined with fine crystals of triple phosphate, resembling the crystals of quartz so often found lining cavities in flints. The explanation of the formation of such cavities is, that the original nucleus was either blood or mucus, which has disappeared by desiccation.

Although in an essay of this kind we cannot enter fully into the chemical analysis of urinary calculi, yet we have deemed it advisable to introduce the following oft-quoted table of Dr. Bence Jones,* somewhat modified:

Urinary calculi.

A. Destroyed by heat; combustible; leaving only a small residue:

1. Become red on the addition of nitric acid, and form a mu-
reuxide:

- | | | |
|--|---|-------------------|
| <p>a. Soluble in carbonate of potash, evolving <i>no</i> ammonia; soluble in caustic ammonia, or potash; on the addition of an excess of acid crystallises in angular crystals; not soluble in water</p> | } | Uric acid. |
| <p>b. Soluble in carbonate of potash, evolving ammonia; soluble in water when boiled; solution in water with a few drops of ammonia, when evaporated, crystallises in needles</p> | } | Urate of ammonia. |

2. Do not become red on the addition of nitric acid:

- | | | |
|---|---|---------------------------|
| <p>a. Soluble in ammonia, <i>not</i> crystallising when evaporated; insoluble in carbonate of potash; dissolves without effervescing in nitric acid, leaving a lemon-coloured residue; soluble in strong sulphuric acid, not precipitated by dilution</p> | } | Uric or xanthic oxide. |
| <p>b. Soluble in ammonia, crystallising in six-sided plates when evaporated; soluble in strong caustic potash; the solution, when boiled for a few moments, on the addition of a drop of dilute acetate of lead, gives sulphuret of lead</p> | } | Cystic oxide, or cystine. |
| <p>c. With difficulty soluble in ammonia, not crystallising; with nitric acid becomes bright yellow; solution in caustic potash precipitable by acetic acid in an amorphous form; emits an odour of burnt feathers on ignition</p> | } | Fibrinous. |

* *Medical Times*, October 1851.

B. Not destroyed by heat ; non-combustible ; leaving a considerable residue :

1. Soluble with hydrochloric acid ; effervesces *before* heating ;
soluble in mineral acids with effervescence ; solution in
acid when neutralised, gives a precipitate with car-
bonated alkalies and oxalate of ammonia ; soluble in
dilute acetic acid, with effervescence } Carbonate
of lime.
2. Soluble with hydrochloric acid ; effervesces *after* heating ;
soluble in mineral acids without effervescence ; solution
in acid when neutralised gives a white precipitate with
carbonated alkalies and oxalate of ammonia ; insoluble
in acetic acid ; decomposed by strong sulphuric acid,
yielding carbonic acid and carbonic oxide ; and when
boiled with carbonate of soda, oxalate of soda is found
in the solution and precipitated by chloride of calcium } Oxalate
of lime.
3. Soluble with hydrochloric acid ; does *not* effervesce either
before or *after* heating :
 - a. Solution in acid with excess of ammonia gives a white
crystalline precipitate ; with half its bulk of phos-
phate of lime (bone-earth) is very fusible before the
blow-pipe, and gives off an ammoniacal odour ; dis-
solves in acetic acid without effervescence } Phosphate
of ammonia
and
magnesia.
 - b. Solution in acid with excess of ammonia gives an amor-
phous precipitate ; with twice its bulk of phos-
phate of ammonia and magnesia is very fusible
before the blow-pipe } Phosphate
of lime.
 - c. Solution in acid with excess of ammonia gives a white,
partly crystalline, partly amorphous, precipitate ;
without addition easily fusible before the blow-pipe } Mixed
phosphates.
4. Not acted upon by acids or alkalies ; fused with twice its
bulk of carbonate of soda forms glass } Silica.

We will now give a general description of each variety of calculus.

1. The *uric-acid calculus* is the most frequent, and was discovered by Scheele in 1776. Calculi composed entirely of uric acid in the several collec- tions bear the proportion to all other calculi as 1 to 4 and 5 ; and, as a nu- cleus in compound calculi, from 1 to $1\frac{1}{4}$ and $2\frac{1}{3}$. The colour is generally light brown, but may vary from pale fawn to a rich brown ; and may sometimes resemble old mahogany or polished oak ; the surface may also be coated with a crust of amorphous urate of ammonia or phosphate of lime, giving a white appearance ; and the nucleus, although consisting of pure uric acid according to Dr. G. O. Rees, may be quite white, owing to the absence of colouring matter. The size varies greatly, and it often attains considerable bulk ; the weight and specific gravity is intermediate between the oxalate and the phosphate ; the form is generally ovoid, laterally compressed and smooth, but sometimes beset with small smooth tubercles, which may be in- creased to such an extent as to make the stone resemble the oxalate of lime.* the calculus may also mould itself into irregular shapes in the locality in which it may be placed. The appearance on section varies extremely ; Dr. Thudichum† describes it to consist of concentric layers of variable thickness, every layer preserving its own thickness pretty regularly all round the cal- culus ; the texture is best seen on the surface ; in the hard and pure varie- ties it is crystalline and fibrous, the fibres of each layer verging like radii towards the centre of the stone, and their fracture being almost parallel with those fibres ; the less dense and pure calculi are of a more earthy character

* See prep. no. 2125, Guy's Hospital Museum.

† Thudichum *On Urinary Deposits*, &c. p. 111.

and amorphous in fracture, having no laminæ. Some few are so hard as to impart a ringing noise on percussion, a sharp sound like a pebble. Here the fracture is conchoidal, and such stones when broken, as in lithotritry, form sharp angular fragments, which are dangerous from their tendency to wound the bladder and urethra.

2. The *urate-of-ammonia calculus* is not common; it was discovered by Fourcroy and Vauquelin in 1798. In the Museum of the Royal College of Surgeons, Edinburgh, there are only 14 in 649 calculi, being 1 in 46; at Guy's there are 7 in 394: but this substance forms an important constituent of compound calculi, varying from 1 in $3\frac{1}{4}$ to 1 in $7\frac{1}{2}$ of all calculi. These calculi are seldom large, are generally ovoid and smooth, or sometimes slightly tuberculated on the surface. Their colour is very generally characteristic, being of a slate, pale grayish-fawn, or clay colour; not unfrequently they more nearly resemble pipe-clay in tint; sometimes there is an admixture of red or brown, and in rare instances pink layers are observed near the centre. In the Guy's Hospital Museum (no. 2213) there is a remarkable collection of 142 calculi removed from the bladder of one patient by Sir Astley Cooper, all of the same figure, being cubes rounded at the edges and angles; these have the colour of pipe-clay, and are chiefly composed of urate of ammonia: it is curious that the patient had afterwards another calculus, which on examination proved to be of a different kind from these. Their consistence is usually compact, earthy, and very brittle, and they have a fine earthy fracture; this is well shown in a calculus (Guy's, no. 2136³⁰), where there is a remarkable fissure running through it, as if it had been fractured and subsequently reframed by a deposit of urate of ammonia. They seldom present the distinct concentric arrangement of uric-acid calculi, generally appearing homogeneous, but at times an indistinct thin laminated condition may be traced; this circumstance is readily explained by the frequent amorphous condition in which the urate is deposited in sediments. These calculi are generally observed in children, and are said to give rise to little constitutional disturbance.

Calculi of urates of soda or lime are not met with; the salts are generally mixed with those of urate of ammonia or uric acid in the several layers of compound calculi. In one instance, however (Guy's Hospital Museum, no. 2154³⁶), there is a fusible calculus with a nucleus of urate of lime.

3. *Uric oxide or xanthic oxide or xanthine*, discovered by Dr. Marcet in 1815, is a very rare calculus, of which only four specimens are recorded. The calculus in which Dr. Marcet first detected this substance weighed but eight grains, and nothing is known regarding the portion not consumed in the analysis; it does not exist in the collection at Guy's Hospital, and neither Dr. Prout, Dr. Yelloly, nor Dr. Babington can give any information on this point. It was rediscovered by Dr. Stromeyer: the calculus was removed by Langenbeck from a peasant's child eight years of age, at Hanover. In shape it resembled a flattened pullet's egg: it broke into three pieces during the operation. The whole calculus weighed nearly 339 English grains; its section was partly of a lustrous bright brown colour and partly earthy and pale. It was composed of concentric separable layers, without any appearance of a crystalline or fibrous texture: it possessed a distinct nucleus, which did not, however, differ in chemical characters from the body of the calculus. It was as hard as uric-acid calculi generally are, and on slight friction it assumed a wax-like lustre. Professor Merx of Göttingen sent two fragments of the calculus to Dr. Willis, one of which is in the Museum of the Royal College of Surgeons, Edinburgh, and the other is in the Guy's Hospital Museum (no. 2145³⁰). In the Catalogue of Calculi at the College of Surgeons of England there is a plate of this calculus (see plate xii.). The calculus bears a close relation to uric acid, and seems to depend on an imperfect oxidation of the material from which, by the ordinary processes of the kidney, uric acid is eliminated.

4. The *oxalate-of-lime calculus*, discovered by Wollaston in 1797, is the

* *Annalen der Physik*, Band 41, p. 393.

next most frequent after the uric-acid calculus, and bears the ratio of 1 in 14½ to 1 in 20 of other calculi. These calculi do not generally attain a very large size, but are very compact, dense, and proportionately heavy. As a nucleus in compound calculi, its proportion varies from 1 in 4¼ to 1 in 7½.

Dr. G. Bird* thus describes these calculi: Their form or external configuration is almost invariably that of a tubercular, angular, or spinous character, and rarely perfectly smooth, which, together with their colour, varying from gray to a rich brown or almost black, have gained for them the specific name of "mulberry." In some calculi the surface is studded with spines so acute and slender as to resemble thorns; in others there is a coating of acute octahedrons of transparent oxalate of lime, giving an extremely beautiful appearance. Sometimes these crystals are opaque, and the octahedron is remarkably flattened: the calculus then looks as if studded with pearl-spar.† Dr. G. Bird observes: "It has been supposed that the spinous and irregular form of these calculi depends upon their being formed in the kidney, and that they were casts of the pelvis and calyces of the organ. This, however, is by no means sufficient to account for their figure; for no calculus so closely becomes a cast of the interior of the kidney as the fusible variety, and yet this ever presents a tolerably smooth surface, however contorted in figure. It is, therefore, more likely that the constantly crystalline state in which the deposit of oxalate occurs has more to do with it; and without calling to our aid any very fertile imagination, a tendency to a cubic or octahedral outline can often be traced to the entire calculus." Sometimes these intervals between the projections or spines are filled up by some amorphous substance, as urates, or phosphates, thus giving the whole an ovoid character. The appearance on section is generally that of an imperfectly lamellated structure, the consecutive layers forming waving lines, and often resembling knotted heart of oak; occasionally there is seen a layer of oxalate of lime arranged round the interior one with great regularity, having a remarkably radiated appearance, like a series of infinitely minute needles placed side by side, and presenting a perfectly porcellaneous structure. In compound calculi the oxalate of lime deposition gives to the character of a stone a remarkably beautiful appearance resembling that of fortification agate.

The rarer varieties of oxalate-of-lime calculus are the following:

1st. The small, smooth, globular "hemp-seed calculus" described by Dr. Wellaston, and thus alluded to: "It is of a much lighter colour, so as to resemble in hue as well as smoothness the surface of a hemp-seed." There may be one or many, and they are generally found in the kidney.

2d. Where the character of the calculus is crystalline throughout, and it has a white or pale brown colour. These calculi consist of nearly pure oxalate of lime in a crystalline form. Dr. Yelloly, on analysing the calculi in the Norwich Hospital Museum, met with not less than twenty examples of such crystallisation. The author has removed by lithotomy a calculus consisting of pure oxalate of lime, and of a pale brown colour, which crumbled to pieces immediately after extraction, a circumstance which was due to the absence of any binding material, there being no trace of animal matter.

The third variety is the pure white oxalate-of-lime calculus. This is of a milk-white colour, possesses a highly polished surface, is of extreme rarity, and is generally, if not always, found in the kidney; its external surface presents no crystals, but is perfectly smooth, though it may be spinous.‡ This variety seems to have escaped the attention of writers on stone. In the Museum of the Norfolk and Norwich Hospital are three specimens: the first, a moist preparation representing a renal calculus of cauliflower shape and of great magnitude; it occurs in the form of a single mass, filling a greatly distended pelvis. From this mass there branch out other smaller masses, which

* *Guy's Hospital Reports*, series i. vol. vii. p. 213.

† See prep. 2139²⁵ in the Guy's Hospital Museum.

‡ For the detailed account of this variety we are indebted to Mr. Charles Williams, House-Surgeon to the Norwich Hospital.

fill up the infundibula. The whole kidney is greatly enlarged. The stone is extremely white, quite smooth, very hard and compact, and polished; it resembles Parian marble. The only circumstance known of its history is, that the preparation was removed from a man after death.

The second example is a small calculus, very smooth and shining, weighing ten grains, about the size of a horse-bean, said to have been passed by an adult female. On analysis it yielded oxalate of lime.

The third specimen is nearly spheroid in shape, and about the size of an ordinary marble; it is of a white colour, though not so polished as the above two are; its external surface is covered with spines and tubercles peculiar to the "mulberry calculus," which it most closely resembles in every thing but colour. Its tubercles are smooth, *i.e.* they are devoid of crystals; its weight is forty-five grains. The catalogue informs us it was passed by a female, aged twenty, who was pregnant at the time. On scraping its surface, and placing the débris under the microscope, very minute octahedra of oxalate of lime were detected: they were insoluble in potash and acetic acid, and thus distinguished from other substances which they resemble.

In reference to this Mr. Williams remarks: "I am inclined to believe that the pure white colour of the third variety of oxalate-of-lime calculus is due to the circumstance that it is met with only in the kidney, and that while in that organ it is not permitted to lie continuously in urine, and therefore cannot acquire the dark brown or almost black hue which the oxalate-of-lime calculus generally assumes when situated in the urinary bladder. The tuberculated form of this calculus, in consequence of its roughness, causes the mucous membrane of that viscus (the bladder) to pour out blood far more frequently than any other variety of calculus; and there can be but little doubt that the colour is derived from the hæmosin, which has been abstracted by the urine from the blood-corpuscles, and remains suspended in it."^{*}

The smooth polished surface of the hemp-seed and white oxalate-of-lime calculi is acquired by the constant trickling of urine over them.

5. The *cystic oxide*, or *cystine calculus*, discovered by Wollaston in 1810, is a rare calculus. It differs from all others in containing a considerable proportion of sulphur, no less than two atoms being present in every equivalent of the oxide. The calculus is not a product of the bladder, as its name would seem to imply, but of the kidneys; and there is a remarkable hereditary disposition to its formation, for out of 22 collected cases, 10 occurred in four families, and in 3 cases the subjects of the complaint were brothers. Ten specimens in the collection of Guy's Hospital were passed by the same patient, whose age was 30; 3 were passed in the year 1814 (no. 2144), 6 small ones subsequently (no. 2145), and in 1828 another remarkable one, of the shape of an ear-drop (no. 2145³⁵).

These calculi are usually small in size; the largest is in the University College Museum, and weighs 850 grs.; at St. Bartholomew's there is one, weighing 740 grs. The one at Guy's Hospital (no. 2143), the second specimen analysed by Dr. Wollaston (the discoverer), is described by him in the *Phil. Trans.* for 1810; it is an inch and a fifth long and one inch broad.

They are described to be generally rounded and smooth, but may be covered either with smooth tubercles or sharp projections externally; they have a wax-like lustre, appear semi-transparent and glistening, and resemble very much the ammoniaco-magnesian phosphate calculus. When recent, their colour nearly approaches that of the uric-acid calculus, being of a pale yellowish brown; they undergo, however, a remarkable change by long keeping, turning slowly from brown to gray or green. Thus the calculus in Guy's Hospital Museum (no. 2143) was brown in 1817, now it possesses a rich bluish-green colour. Some consider that the greenish-blue or dirty-green colour is due to the

* Hæmorrhagic urine, filtered so frequently as to lose all the corpuscles, when examined under the microscope will be found to possess the dark blood-stained colour notwithstanding.

presence of earthy phosphates. Dr. Bird, however, remarks, "It has been suggested to me by both Dr. Prout and Dr. Willis, that this alteration in tint may in some way depend upon changes produced by the sulphur." Their consistence is soft, and on section they present a very imperfectly radiated structure, and exhibit no tendency to a development of concentric layers; when scraped, they yield easily to the knife, and form a perfectly white powder, whether the calculus be brown or green. The fracture is crystalline.

6. The *phosphate-of-lime calculus*, discovered by Wollaston in 1797, is likewise rarely found in the bladder uncombined with other salts; and it seldom forms the nucleus of other calculi. Calculi chiefly or entirely composed of it are tolerably hard and smooth externally, not presenting the angular asperities of the oxalate of lime, or the contorted and irregular figure frequently assumed by the fusible calculus: sometimes they consist of two or three portions fitting into each other in a variety of ways.

Of three specimens in the Guy's Hospital Museum, the first (no. 2148) presents a porcellaneous appearance externally, admitting of considerable polish by friction; is conchoidal in its fracture, and is of a grayish-white colour: the second (no. 2149) is more regular in figure, and is made up of a series of concentric layers of the phosphate, readily distinguished from each other by their tint, being alternately white and fawn-coloured: the third (no. 2150) is light-coloured and has a spongy, cancellated structure, and looks more like a bony concretion than a deposition.

There are, however, two varieties of this form of calculus; the one, as described by Wollaston, of renal origin and consisting of neutral phosphate of lime; and these are usually pale brown, with a smooth polished surface regularly laminated, and the laminae so slightly adherent as to be easily separable into concentric crusts; in some, radiating lines are seen in a direction perpendicular to the laminae: these calculi contain a considerable proportion of animal matter. The other form is of vesical origin, and composed of phosphate of lime, similar to that of bones, and hence often called "bone-earth" calculi; they are more common than the former, and constitute irregular masses resembling mortar, or a granular semi-crystalline powder, enveloped in a tenacious mucus. Dr. Taylor, in the Catalogue of Calculi of the Royal College of Surgeons, England, has described some specimens as consisting entirely of this salt.

The phosphates are scarcely ever succeeded by any other form of calculus, but there are three instances in which a phosphatic calculus was succeeded by uric acid or urate of ammonia, and in one instance it was followed by oxalate of lime; the general ratio in which they succeed other deposits is 1 to $4\frac{1}{3}$. Foreign bodies as a rule have earthy phosphates deposited upon them; but there is one remarkable exception (Cat. of the Royal College of Surgeons of England, plate iv. fig. 6) where a slender piece of steel formed the nucleus of a large oval calculus, consisting almost entirely of uric acid.

Respecting the earthy phosphates in calculi Dr. Thudichum remarks: "Not quite 10 per cent of all calculi have a nucleus of mixed phosphates; but these substances enter into the composition of about 34 per cent of all calculi, forming either their body, one or more layers, or the crust. This shows that the presence of deposits of mixed phosphates in the urine scarcely ever gives rise to the formation of calculus, but that the presence in the bladder of other calculi frequently cause a deposit of phosphates to be formed around them, in which respect every calculus is nothing else than a foreign body. For such a concretion to form, it requires the presence of some binding material, such as ropy mucus, or a clot of blood or fibrine, in hæmaturia and chronic disease of the mucous membrane of the bladder."

7. The *triple-phosphate calculus*, or ammoniaco-magnesian phosphate, also discovered by Wollaston in 1797, is rare; there are three in the Museum of the Royal College of Surgeons of England, and one or two only at Guy's Hospital: in the former collection they appear as a white crystalline mass, radiating from the centre, and having the surface studded with shining crystals, which, when recent, are nearly transparent, but by exposure become opaque; their

texture is earthy, friable, and imperfectly lamellar; some are hard and compact, semi-transparent, and crystalline in fracture like alabaster. In the Guy's collection (no. 2154) a calculus of this kind is to be seen which has no nucleus, but a central cavity lined with delicate crystals of triple phosphate, resembling the crystals of quartz in the cavities of flints; and no. 2152 is a section of a large calculus of the kind on a nucleus of a tobacco-pipe. Dr. Thompson mentions a calculus of this sort weighing nearly 2lbs.

8. The *fusible calculus*, or mixed phosphate, or the phosphate-of-lime and phosphate-of-magnesia and ammonia calculus, discovered by Wollaston in 1797, is the most frequent of the phosphatic calculi, and forms rather more than $\frac{1}{12}$ of all calculi, being rarely succeeded by any other species of urinary deposit; their relative proportions in the several collections are various, from 1 in $8\frac{1}{2}$ to 1 in $13\frac{1}{2}$.

These calculi grow to a considerable extent, and are comparatively light and of low specific gravity; they are generally very irregular, and mould themselves to the situation in which they are placed, often filling the interior of the bladder, and becoming impressed with its rugæ; sometimes they are globular and ovoid, at other times taking on the most extraordinary shapes; where there are two or more, they assume a cubic or tetrahedral form. Their colour is white, gray, or dull yellow, and their consistence is more friable and earthy than any other variety, and is sometimes so soft as to resemble moist chalk.

Their appearance on section is thus described by Dr. Taylor (op. cit.): "They are frequently composed of concentric laminæ, which in general adhere but slightly to each other; between the laminæ shining crystals of the triple phosphate are often observed; in some the laminæ are entirely wanting, and these form a white friable mass like chalk; in others they appear semi-crystalline, as if made of numerous small crystals confusedly aggregated together. The relative proportion of the constituents of this calculus is exceedingly various, and the predominance of one or the other salt gives peculiar characters; in those which have a crystalline and glistening texture the triple phosphate is most abundant, while the calcareous phosphate is in excess in those which have an amorphous earthy appearance."

It generally constitutes the calculous masses deposited on foreign bodies accidentally or intentionally introduced into the bladder.

9. The *carbonate-of-lime* calculus, discovered by Brugnatelli in 1819, is a very rare form indeed. He describes* forty-eight small concretions extracted from the bladder of a young man: these were of the size of a pea, lamellar in structure, and broke with a shining fracture. He also mentions several ash-coloured calculi, sixteen in number, and of the size of a nut, which were composed of carbonate of lime with a trace of carbonate of iron: these were removed after death from the bladder of a woman. Dr. Prout has also seen small calculi of this salt; and these were perfectly white and very friable.

In Guy's Museum, no. 2182⁷⁷, there are some calculi of carbonate of lime, with mere traces of carbonate of magnesia and alumina; in one specimen, no. 2187⁸⁰, it constitutes the body of a calculus, being deposited of a snow-white colour on a nucleus of uric acid. There are several in the Oxford Museum, among the collection of Mr. Hitchens; and there is in the possession of Mr. R. Smith of Bristol a remarkable collection of these calculi, some of which are figured in the catalogue of the Royal College of Surgeons of England, plate xii. figs. 3, 4, 5, 6, and 7. Of these calculi, five were extracted by the lateral operation from the bladder of a boy aged 16, and the other fifteen were passed by the urethra previous to the operation: these latter were of the size of peas, of a rounded figure, and had flattened surfaces; they were compact and lamellar in structure, and their external surface was of a light brown colour. Those extracted by operation were exceedingly irregular,

* *Litologia Umana*, Pavia, 1819.

and their external surface dusted over with white powder; the largest was of the size and figure of a large almond; when sawn through, the concretion showed no concentric laminæ, but irregular waved lines similar to those of the mulberry calculus. The largest was so hard as to require the assistance of the lapidary's wheel to divide it.

Prostatic calculi sometimes consist almost entirely of this substance, but, as Dr. Thudichum observes, "it is always questionable whether the lime or the carbonic acid were in any case derived from the urine."

10. The *fibrinous calculus* of Dr. Marcet and of Dr. Prout is by some not ranked among calculi, in consequence of its differing so totally from those other concretions. Dr. Bird* says, "It must be regarded as a portion of dried inspissated albuminous matter exuded from an irritated kidney, rather than as a calculus produced under circumstances at all analogous to those of other concretions. Several specimens exist in the Guy's Museum of the pelvis of the kidneys and ureters being obstructed by clots of fibrine; but none of them present the hard concrete condition of the calculus described by Dr. Marcet. I am not aware of this variety having been mentioned by any other author except Brugnatelli, who, in his *Litologia Umana* describes some calculi as consisting of crystallised albumen; they were passed by one individual, and each was about the size of a nut. These pseudo-calculi appeared to consist of dried coagulated albumen, which not unfrequently presents considerable lustre and a vitreous fracture, although scarcely sufficient to justify its being regarded as crystallised." Some have described it to resemble yellow wax in appearance, and others have regarded it as an elastic organic substance closely allied to fibrine.

11. The *uro-stealith calculus* is another of the pseudo-forms: it is not decided whether it is a resin or fat, and its elementary condition is entirely unknown. It has been described in Heller's *Archives* (1844, p. 97, and 1845, p. 1), and it consisted of several small bodies composed of a peculiar form of fatty matter, which were passed by a man, aged 24, who suffered from symptoms of stone in the bladder. Dr. Moore of Dublin has confirmed the existence of this substance, and has examined several specimens sent to him by Dr. Robert Adams of Dublin.†

12. *Blood calculi* have been but recently discovered, and are likewise pseudo-calculi. Those described by Dr. Alison‡ were found in the infundibula and pelvis of the kidney of a painter, aged 52, who died of consumption; black calculi occupied the pelvis, while the infundibula were tenanted by a few calculi of a whitish-gray colour, with one exception small in size, about the magnitude of pear-seeds, and wanting the ordinary physical characters of phosphate of lime. One calculus which occupied the infundibulum was the size of a horse-bean, looked somewhat worn and disintegrated, and at one point resembled a piece of decayed wood, and was black on one side from the presence of altered blood; it was very light in weight, and was composed of blood and phosphate of lime. The black calculi, which formed the chief point of interest, were about six in number, and ranged from the size of a coriander-seed to that of a small horse-bean; when found, these black calculi were tolerably hard, but being friable they broke asunder on handling; the fractured surface varied a little in colour, in some parts presenting a dark rusty appearance. Liquor potassæ dissolved them, and they were capable of partial combustion; the microscope revealed only amorphous particles, but Dr. G. O. Rees, with the assistance of a neutral saline solution, discovered forms which he considered to be the remains of blood-corpuscles.

Silicious concretions are not met with, although silica has been met with in other calculi, by Berzelius, Vauquelin, Fourcroy, and others. Those which have been extracted from the bladder have been pebbles or small stones introduced from without.

* *Guy's Hospital Reports*, series i. vol. vii. p. 180.

† *Dublin Quarterly Journal of Med. Science*, May 1854, p. 473.

‡ Dr. Scott Alison, *Archives of Medicine*, vol. i. p. 245.

There are certain predisposing causes and conditions which are supposed by some to influence the formation of stone, or tend to its production; to these we can only cursorily allude. Thus, respecting climate and locality, it is stated that calculus is more frequent in temperate than in warm and cold regions, but more especially in humid and moist countries of moderate and changeable temperature, such as Holland, France, England, and Germany. It is, however, met with very frequently in Egypt, Isle of France, Bagdad, Russia, and both the Indies. Even in some parts of the same country it is more prevalent than in others, as in Norfolk in England.

With regard to race, it is asserted that the disease is much more frequent among the white than the dark; and Liebig attempts to explain this by suggesting that the exemption of the people of China from gout and calculus is due to the urine containing large quantities of tartar. However, stone is excessively common among the natives of India.

In some cases it may be traced to hereditary transmission, especially where there is gouty diathesis.

The sex modifies the relative proportion, stone being less frequent in females than males, their proportion being 1 to 20, or 1 to 23. This is due to the peculiar anatomical disposition of the urethra in the female, viz. its shortness, and its capability of dilatation allowing the easy passage of a small stone; as also to the comparatively temperate and regular habits of life of females.

The age at which calculi are most frequently met with is said to be in the young and in old people. This can only be ascertained by statistics, which are for the most part imperfect. The table furnished by M. Civiale gives the following results of 5376 cases: Under 20 years of age, 55.56 per cent; between 20 and 40, 14.69 per cent; between 40 and 60, 14.95 per cent; and above 60 years, 14.76 per cent. That of Mr. Coulson,* of 3264 cases: Under 20 years of age, 71.20 per cent; between 21 and 40 years, 12.10 per cent; between 41 and 60, 10.87 per cent; and between 61 and 80, 5.72 per cent. That of Mr. Henry Thompson,† of 1827 cases: Under 20 years of age, 60.42 per cent; between 21 and 40, 10.18 per cent; between 41 and 60, 17.56 per cent; and between 61 and 81, 11.83 per cent.

Mr. Thompson's cases are derived from the entire experience, during given periods of time, of the following hospitals: Guy's, St. Thomas's, University College, Norwich, Cambridge, Oxford, Bir-

* Coulson *On the Bladder*, &c. p. 402.

† Thompson *On Practical Lithotomy and Lithotrity*, p. 269.

mingham, Leicester, and Leeds. It is quoted in a foot-note,* and we have rearranged the statistics derived from this table according to the different epochs or periods of life. Thus under puberty, from 1 to 13 years of age, there are 940 cases, or 51·45 per cent of the whole number; and this we may subdivide into two phases, viz. infancy and childhood, from 1 to 5 years, 473 cases, or 25·89 per cent; and boyhood, from 6 to 13 years, 467 cases, or 25·56 per cent. At puberty, and during adolescence and approaching manhood, from 14 to 26 years, 228 cases, or 12·47 per cent. During the next ten succeeding years, from 27 to 36 years, 80 cases, or 4·37 per cent. At adult life, from 37 to 49, 127 cases, or 6·95 per cent. In advancing life, from 50 to 70, 414 cases, or 22·65 per cent; and in old age, from 71 to 81, 38 cases, or 2·07 per cent.

Mr. Coulson aptly remarks, "that tables exhibiting the number of calculous persons at different ages of life do not show the liability of individuals to be attacked at these different ages." Here, as in many other statistical tables, an error has crept in from not taking care to distinguish between absolute and relative numbers of persons living at the several periods of life enumerated. Corrected in this manner, the tables would show that children and young persons are less liable to calculous disorders than has been commonly supposed, and that from 20 years and upwards the tendency goes on increasing in a very remarkable manner to the end of life; or, as Mr. Thompson puts it, "that the proportion of elderly calculous patients to the existing population at their own ages is larger than

* Table of prevalence of Stone in 1827 cases of Lateral Lithotomy at different ages :

Age.	No. of cases.	Age.	No. of cases.	Age.	No. of cases.	Age.	No. of cases.
1 . . .	7	22 . . .	10	43 . . .	11	64 . . .	16
2 . . .	74	23 . . .	9	44 . . .	4	65 . . .	26
3 . . .	116	24 . . .	12	45 . . .	17	66 . . .	20
4 . . .	153	25 . . .	11	46 . . .	11	67 . . .	14
5 . . .	123	26 . . .	10	47 . . .	15	68 . . .	17
6 . . .	90	27 . . .	5	48 . . .	6	69 . . .	8
7 . . .	86	28 . . .	6	49 . . .	10	70 . . .	16
8 . . .	49	29 . . .	11	50 . . .	23	71 . . .	8
9 . . .	57	30 . . .	11	51 . . .	15	72 . . .	5
10 . . .	60	31 . . .	3	52 . . .	11	73 . . .	4
11 . . .	35	32 . . .	14	53 . . .	17	74 . . .	2
12 . . .	58	33 . . .	7	54 . . .	25	75 . . .	9
13 . . .	32	34 . . .	9	55 . . .	23	76 . . .	4
14 . . .	35	35 . . .	9	56 . . .	26	77 . . .	0
15 . . .	26	36 . . .	5	57 . . .	25	78 . . .	1
16 . . .	27	37 . . .	3	58 . . .	16	79 . . .	0
17 . . .	18	38 . . .	14	59 . . .	22	80 . . .	4
18 . . .	26	39 . . .	4	60 . . .	33	81 . . .	1
19 . . .	19	40 . . .	21	61 . . .	17		
20 . . .	13	41 . . .	4	62 . . .	22		
21 . . .	12	42 . . .	7	63 . . .	22		

1827

the proportion of children afflicted is to the number of existing children."

The condition and habits of life have some effect as a cause. Thus sedentary habits impair the functions of the skin, and give increased work for the kidneys; so also luxurious feeding and use of malt-liquors and nitrogenised food in excess furnish a source from which concretions are derived; again, indigestion, mal-assimilation and fermentation, impairment of the vital powers, acidity generated in the stomach, are frequent causes.

Respecting the exemption of sailors and soldiers from this disease, as alleged by Mr. Copland Hutchinson and others, we have not sufficient data to go upon.

Morbid states of the urinary passages may predispose to calculous formations, and more especially the presence of a foreign body, which is sure to cause a precipitation and deposit on its surface.

With regard to the influence of certain kinds of waters and spas, as a beverage, in inducing stone, it has been proved to be entirely imaginary: none of the forms of calculi correspond with the salts which exist in natural waters.

We shall now proceed to the description of the symptoms, effects, and treatment of urinary calculi as met with in the bladder, prostate, and urethra. Those of calculi in the kidney and ureter are described in the essay on DISEASES OF THE URINARY ORGANS, pp. 330-333.

Stone in the bladder. A vesical calculus may consist of every possible variety of the urinary concretions already described. Whatever may be the nature of the calculus, when once it exists in the bladder, it acts as a foreign body, and will give rise to sufficient evidence of its presence by inducing certain symptoms, so as to lead the Surgeon to its detection. Of course all these symptoms are not uniformly met with; they may vary in degree and intensity, depending upon a variety of general and accidental circumstances, so that it will be prudent to have some standard as indicating the symptoms which are generally met with in patients suffering from a stone in the bladder. The symptoms are premonitory and actual. The premonitory symptoms can exist only in those cases where the stone is of renal origin, so that in many adults and old people the vesical troubles are preceded by paroxysms of nephritic colic; but in general these antecedent complaints, attending the formation of stone in the kidney and its passage along the ureter, are so severe, that directly the calculus has reached the

bladder a more or less long interval of repose and quietude allays all further suspicion, and nothing more is thought of the complaint until the calculus has reached a sufficient size to be incapable of being expelled through the neck of the bladder.

The actual symptoms or signs of a stone in the bladder consist of two kinds; first, those evinced by the patient's sensations, &c., constituting the subjective or rational symptoms, which offer but presumptive evidence of calculus; and secondly, those signs detected through the aid of mechanical means, and termed physical signs, the only real method of determining and diagnosing the presence of a stone.

The subjective or rational symptoms consist of the following complaints: There is pain and sensibility, of a more or less acute character, referred to the region of the bladder or its neck; this may amount to a mere uneasiness or sensation of weight in the bladder, perineum, or hypogastrium, which may be so slight as to be unnoticed by the patient; or, on the other hand, the pain may be very severe and intense, occurring in paroxysms of great agony.* At first the pain is generally only intermittent, occurring during and after micturition, and more especially with the last drops of urine; and in children this is so frequent, and is attended with such irritation at the extremity of the penis, that they endeavour to allay it by drawing the penis and prepuce forwards; and this gives rise to an elongated condition of the prepuce, which is generally sodden with urine, as are also the fingers, causing them to emit a urinous smell. The pain is also aggravated in the acts of walking, riding, jumping, sudden exertions, jolting of the body, &c., and its intensity generally increases with the advance of the disease. Oftentimes the pain is reflected along certain nerves, inducing morbid sensations at their peripheral extremity; thus pain is experienced in the extremity of the glans penis, in the scrotum and testicle, inducing contraction of the scrotum and swelling of the testicle, in the perineum, kidneys, down the thighs, &c. John Hunter† quotes the remarkable case of the father of Lord Cavendish, who had pain in the left arm associated with calculus in the bladder, and this was the only indication of a want to make water. Some have had tormenting violent pains in the soles of the feet, with numbness and tingling.

The pain may last a considerable time, and then suddenly cease altogether, giving rise to the supposition of a cure. Such was the

* The pain was so severe, continuous, and intense, that a blacksmith at Amsterdam, and a cooper at Königsberg, performed self-lithotomy.

† Hunter's Works, edited by Palmer, vol. i. p. 321.

case with the patient of M. Morand, mentioned in the *Mémoires de l'Académie des Sciences*, 1740, where a catheter detected a vesical calculus, but after that all symptoms gradually subsided, so that M. Morand was considered to be in error, and the patient bequeathed him his body to teach him a lesson; but on the post-mortem examination three calculi of the size of apricot-stones were found on one side of the bladder. On the contrary, a stone may exist and grow to a considerable size without any evidence of pain, and then pain may all at once occur after some act of exertion. Thus it happened in the case of a priest, who was in the act of taking some books off a shelf, when sudden symptoms occurred, after which the presence of a large stone was detected: here in all probability the calculus had been lodged, and then suddenly ejected from its hiding-place. Pain may be altogether absent; and such is the case when there is paralysis of the bladder, since then there is no desire to urinate, nor any efforts to expel the urine. After all, pain is no positive sign, for it may occur in other diseases; hence it merely directs the attention of the patient and Surgeon.

In gouty patients a calculus in the bladder is attended with much pain and irritability, which is sometimes so severe that relief is anxiously implored.

Associated with pain is an alteration in the act of micturition: ordinarily there is a frequent desire, from irritation of the neck of the bladder, and there are futile attempts to evacuate the last drop; again, during the flow of urine there may be one or more sudden stoppages, but for a moment only, the stream reappearing in the ordinary manner. At times there is experienced considerable difficulty in urinating, and in some rare instances this has amounted to retention. In cases where the stone has attained a very large size, filling up and occupying the whole cavity of the bladder, incontinence of urine takes place, so that the urine flows in drops, the bladder having no room for receiving the fluid. All these varieties are not peculiar or essential to the presence of stone, for they are met with in other diseases of the bladder and urethra.

The character of the urine is of little assistance in the diagnosis, for urinary deposits may exist without calculus, and calculus may be present without any deposit whatever. The urine may remain perfectly clear and natural for a long period; it may also contain deposits, which may assist in ascertaining the nature of the calculus; but it may become at any moment turbid and mixed with mucus, which will be deposited in the shape of a tenacious matter remaining at the bottom and sides of the utensil, as seen in catarrh of the bladder.

This secretion may become retained in the bladder, and may undergo decomposition, giving rise to a foetid dirty-gray discharge; or it may even assume a puriform character; or it may subside and entirely disappear for a short time. Albuminous urine is now and then met with, and may be due either to the presence of pus or blood in the urine, or it may be owing to diseased kidneys. Some practical deductions might be derived by investigating the relative importance of the different states and quantities of albumen in the urine in cases of stone; but hitherto this has not been done. Lithotomy has been successfully performed on many occasions in cases in which there has been a good quantity of albumen, even without pus or blood.

Hæmaturia is not always present; it generally takes place on expelling the last drop of urine, and occurs from the violent contraction of the bladder upon the stone; it may also result from sudden exertions—the jolting in a cart or carriage, the act of jumping, &c.; but by rest and the recumbent position it will speedily disappear.

Sometimes an erection of the penis is an attendant symptom, and in adults now and then involuntary emissions of semen occur.

In some patients, especially adults, there is tenesmus and a sense of bearing down of the rectum, with frequent and fruitless attempts to pass a stool; in others, especially children, there is frequent defecation, and often fæces are passed at every act of micturition; prolapsus of the rectum occurs very frequently in children, and sometimes in old men.

The physical signs of a stone in the bladder are to be derived from artificial or mechanical aid from without, giving to the senses of touch and hearing on the part of the Surgeon distinct evidence of its presence. The means of attaining this is by the exploration of the bladder with a solid metallic instrument, which, on coming in contact with the stone, enables one to feel the foreign body, and on striking it produces a ringing noise or sound; hence the term “sounding” given to the operation, and “sound” given to the instrument used.

The sound is somewhat similar to a catheter both in size and form, but is made of solid steel, which is well polished on its exterior; its length and size varying according to the age of the patient undergoing examination. The handle of this instrument is expanded and flattened, and also polished, in order to give a larger extent of surface for the fingers and thumb of the operator to receive tactile vibrations. The curve of a sound is generally that of the ordinary catheter; some prefer it shorter, curving at an angle of 45° , and others almost straight, except at its lower extremity, where it is bent or curved, and made somewhat bulbous (see p. 372). The reason why catheters are not ordinarily used is, that they are bad conductors of sound, and the presence of the stilet in the instrument may give rise to a rattling noise, a source of fallacy.

The position of the patient in sounding should be the recumbent one ; but in obscure cases it is necessary to vary this, and even to explore in the standing posture. The rectum should be empty, and the bladder moderately distended with urine. M. Civiale generally injects water previous to sounding.

The sound should be introduced carefully and slowly, and allowed to glide along the canal by its own weight ; no force whatever is required, and in general no pain need be given. Having passed into the bladder, the point of the instrument is to be made to move gently from before backward, then from side to side, and is afterwards rotated slightly on either side, assisted at the same time by a partial withdrawal and reintroduction of the point of the instrument. The operation may be facilitated in obscure cases by the introduction of the finger in the rectum, or by making pressure with the hand above the pubes. In consequence of there being generally some fulness about the rectum, the stone is found oftentimes lodged on the right side ; large calculi are generally near the neck of the bladder, small and medium sized calculi lie at the base to the right or left side.

Sounding not only enables the Surgeon to detect the presence of calculi, but it assists him in ascertaining their size, situation, number, and sometimes density. The size is determined by first traversing the surface of the stone with the convex part of the sound from side to side, and then carrying the point from before backward. The presence of more than one stone may be sometimes detected by careful exploration, although this may prove deceptive where a stone is very irregular. The situation of a stone may likewise be made out, as to its being loose and free, or fixed and encysted ; whether it be on the right or the left side, at the base or in the walls, or in the upper part of the bladder.

The noise emitted on the striking of a stone with the sound has led to opinions that the size and density of the calculus may be thus detected ; for some writers affirm that small and very movable calculi give but a feeble sound ; smooth and dense calculi, as lithic acid and oxalate of lime, have a clear, ringing, sonorous character ; the light, friable, and irregular ones, as the phosphates, emit a dull and scarcely appreciable sound. The smooth surface of a lithic-acid stone, and the rough irregular exterior of the oxalate of lime, may in most instances be detected by the instrument.

Difficulties and sources of fallacy in sounding are not at all unfrequent. Thus, a stone may be detected at one time, and not at another, owing either to its smallness or to its being temporarily caught up in the folds of the bladder ; in fact, small stones easily escape detection, and readily recede before the sound when the bladder is moderately full of urine ; hence in such instances the change from the recumbent to the erect posture may allow the stone to fall on the sound ; or again, the evacuation of the water in the bladder by means of a catheter may cause the stone to be felt. The principal difficulties and sources of fallacy are, however, a large and deformed bladder,—a contracted bladder, unable to contain urine,—a sacculated or encysted bladder,—an irregular hour-glass contraction of the bladder,—calcareous matter adhering to the walls of the bladder,—an enlargement and roughening of the prostate gland,—calculi in the prostate and urethra, and tumours at the neck of the bladder. Again, the calculus may be coated with blood or mucus. Some of these difficulties may be overcome by varying the position of the patient, by the use of sounds of different sizes and curves, and by moderately distending the bladder with two or three ounces of tepid water. The presence of a stricture in the urethra may offer difficulties, which must be overcome in the ordinary manner by dilatation.

Sounding may produce cystitis and peritonitis ; hence caution and gentleness are necessary in its use.

In some instances exploration with a lithotrite has cleared up a difficulty ; but care must be taken not to mistake the opening and closing of the blades for the sensation of a stone. When using the lithotrite and engaging the stone, we can take a very fair measurement of the axis and size of a stone, a point which will be referred to in the section on Lithotrity.

Mr. Henry Thompson* has suggested and employed a modification of the lithotrite, which may act as a sound, catheter, and measurer.

Exploration of the base of the bladder by the introduction of the finger into the rectum may lift the calculus out of the hollow, so that the sound may easily strike it; and in fact in children and in some adults the stone may be felt through the rectum. This examination likewise enables us to detect the presence of polypi, tumours, scybala in the rectum, and such other complaints as may give rise to the symptoms of stone.

In the female, vaginal examination is most important, and on making pressure above the pubes at the same time, the stone may in most instances be felt. Uterine disease, a source of fallacy as simulating stone, may thus be ascertained.

The employment of the stethoscope in the pubic, sacral, and perineal regions is not attended with much satisfactory result. Succussion likewise is of little service; and where there are many stones the patients in their movements readily perform the operation themselves, and acquaint their Surgeon of the matter.

The prognosis of this complaint must always be of a serious character; there are no means whereby we can arrest the disease, unless by removal, through operative measures, of the offending foreign body; otherwise death is the sure consequence at a more or less remote period. Spontaneous expulsion of the stone through the urethra now and then takes place, when small, and in some rare instances nature has effected a cure by causing the stone to be extruded by ulceration through the rectum, vagina, or perineum. These, however, are but exceptional cases. The Surgeon also has to bear in mind that, although a stone has been successfully removed, yet in isolated cases a second or even a third stone may become developed.

The progress and termination of the disease in patients affected with calculi in the bladder are exceedingly distressing and productive of much anxiety. These, of course, will vary according to the condition of the calculus, the constitution of the patient, and the age and temperament of the individual. In some rare instances there are no symptoms whatever, so that it is only after a post-mortem examination that the existence of a stone has been ascertained. In others, again, the symptoms may be sufficiently well marked yet not severe, and may be prolonged over a number of years without exciting any great distress or anxiety. But in ordinary cases there is always an increase of the symptoms, more or less slow, but constant, leading to great anxiety and inconvenience; the patient becomes thin and worn-out, the health impaired, the stomach deranged, and the secretions vitiated. The skin becomes dry and the extremities cold;

* Weiss's catheter-scoop with stop-cock. See Thompson *On Pract. Lithot.* p. 219. This instrument in its original form was constructed for injecting and removing the debris of calculi from the bladder; by the addition of the stop-cock, it is also useful for measuring the size of the stone and for sounding.

the micturition frequent and distressing; and soon atony and atrophy of the bladder takes place, so that there is inability to void the urine except in the reclining posture: the urine, in consequence, becomes in part retained and undergoes decomposition, assuming an ammoniacal and offensive character. Much suffering now ensues; exhaustion, loss of sleep, disturbance of digestion, and low fever set in; next, colliquative diarrhoea, and speedy death.

Such are the ordinary results; but other changes may take place and modify the progress of the case: thus, acute cystitis may attack the patient, as evinced by the intensity of the pain, frequent micturition, and muco-purulent condition of the urine; ulceration of the mucous membrane of the bladder may ensue; acute or chronic inflammation of the kidney, or even acute suppuration of the kidney, may set in, and carry the patient suddenly off by uræmia or pyæmia.

There may be also hyperæmia, hypertrophy of the coats of the bladder, irritable bladder, catarrh of the bladder, dysuria, hæmaturia, ulceration and sloughing, with perforation allowing the escape of the calculus into the peritoneum, rectum, vagina, or perineum; or pelvic cellulitis may be induced, followed by diffused suppuration.

Calculi may become encysted either by means of the formation of a hernial protrusion of the mucous membrane through the muscular coats of the bladder, or by the presence of a parietal abscess of the bladder opening internally and receiving the stone in its sac. Sometimes a large and heavy stone becomes lodged behind the neck of the bladder, and here forming a diverticulum or bed for itself, becomes more or less fixed.

The post-mortem appearances of those who have died with a calculus in the bladder will of course vary, according to the mode of death and the complications which have previously existed. Ordinarily they will consist of chronic cystitis and chronic inflammation of the ureters and pelvis of the kidney, with slow changes in the glandular structure of the organ.

The *treatment* will consist in palliating and relieving the immediate distress, and then resorting to such means as may produce a permanent cure. When a stone has arrived in the bladder, we should acquaint the patient of the fact.

The palliative measures will comprise such treatment as may improve the general health and the secretions and excretions, as well as relieve any complications which may exist, such as catarrh, cystitis, ischuria, enuresis, nephritis, prostatitis, &c. by the methods usually adopted in such diseases. Great attention must be paid to the diathesis of the patient suffering from calculus, as evinced by the nature of the sediment passed, whether it be lithic acid, phosphatic, or oxalate, and this must be treated as laid down in the early part of this essay,—by careful attention to diet and regimen, due regard to the action of the skin and bowels, and the use of sedatives and anodynes to relieve pain; not forgetting to correct the nature of the morbid urine by ap-

appropriate medicines, such as mucilaginous drinks, diluents, &c. Oftentimes the paroxysms of pain are relieved by the recumbent position, with the thighs and buttocks raised, and the body bent forwards to relax the abdominal muscles. A decoction of the *tritium repens* is highly recommended by Mr. Thompson as giving great relief.

The curative means will comprise the removal of the stone from the bladder; and three methods have been advised and adopted: first, the attempted dissolution of the stone by chemical and other agents, such as the far-famed "lithontriptics," and the solution by electrolysis; secondly, the removal of the stone by mechanical means without a cutting operation, such as dilatation of the urethra, and lithotrity; and thirdly, the extraction of the calculus by operative measures, commonly known by the term lithotomy.

The cure by lithontriptics has engaged the attention of surgeons, physicians, physiologists, and chemists, and has been had recourse to by quacks and empirics of all descriptions. Dr. Prout has fully pointed out the importance of the administration of increased quantities of fluid in certain calculous and other affections, showing that many comparatively insoluble substances are slowly dissolved away by the frequent renewals of the fluid in contact with them.

Lithontriptics have been employed internally, through the general system, and the administration of certain medicines and waters, as well as locally by the injection of solvents into the bladder and the use of electricity.

The constitutional remedies generally made use of consist in the prolonged use of alkalies, but often to the detriment of the general health; these are inadmissible in oxalate-of-lime calculi, as the latter resist their influence; so too in phosphatic calculi they are prejudicial, inasmuch as acids are of more beneficial effect in arresting the growth of such stones; but in the lithic acid variety much relief has accrued, and in some instances the growth of the calculus has been decidedly cut short, by the use of such alkalies. The alkaline waters are supposed by some to act not merely by a process of solution, but by causing a kind of disintegration of the component parts of a calculus. *Aquor potassæ* and the carbonate and bicarbonates of soda and potash are the usual medicines employed. The Vichy waters have become renowned as a favourite and useful remedy in calculous disorders; and in some instances persons having undeniable stone, as ascertained by sounding, have had their symptoms relieved, and even removed, whilst partaking of the waters. The Académie des Sciences, in reporting upon the use of alkalies in cases of calculi, thus sums up this subject: "Although we admit that alkaline carbonates are not without influence on calculi, yet these present sufficiently great difficulties in their mode of application to cause them to be regarded with caution."

Some prefer the use of the borate of soda, as being more energetic; and, again, others have suggested the use of gastric juice, malic acid, and the nitrosaccharate of lead as having dissolvent powers. The celebrated nostrum of Sir B. Stevens was made of calcined eggshells and soap.

However, up to the present time no satisfactory remedy has been discovered. The local use of lithontriptics, viz. the injection of solvents into the bladder, has also been sedulously tried, and many experiments have been performed on calculi to ascertain their solvents, which have then been employed by means of injection into the bladder through a catheter. Unfortunately the operation, if strong enough to be of any use, endangers the coats of the bladder, and when diluted its action is uncertain in the extreme. Diluted alkaline solutions are recommended for uric-acid calculi; diluted acids, such as the hydrochloric acid, in phosphatic; and dilute nitric acid in oxalate of lime. Salts of lead, carbonate of lithia, nitro-saccharate of lead, have been suggested; the latter as being less injurious to the bladder.* The free use of the catheter, by introducing it through a double catheter and keeping up a continued stream for half an hour every two or three days, has been employed:

* Sir B. Brodie has shown that phosphatic calculi might be greatly reduced in

Dr. Willis has recommended that the fluid should be placed in a reservoir at a sufficient height above the patient, and connected with the catheter by a tube provided with a stop-cock, by which means the flow of the solvent may be carefully regulated.

M. Pelouse, in the 14th vol. of the *Comptes Rendus* of the Académie des Sciences, thus sums up the conclusions that have been arrived at: 1st, the effects of different agents upon urinary calculi proceed very slowly, and are chiefly evinced upon the animal matter which enters into their composition; 2d, drinks and baths never effect a cure; 3d, the results of injections are problematical, and the danger of inflammation is not counterbalanced, as in lithotrity, by a rapid destruction of the calculus; 4th, although the combination of lithotrity with injections increases the probability of success, yet it is most desirable to proceed with lithotrity.

The dissolution of calculi by electricity (electrolysis) has had its advocates. Sir W. B. O'Shaugnessy has recommended the transmission of an electric current by means of a properly constructed instrument; but it is difficult in its application, and is attended with risks to the bladder. The latest and most successful efforts are those of Dr. Bence Jones, who employed a solution of nitrate of potash, and decomposed this by the aid of a powerful galvanic battery. The nitric acid set free at the positive electrode would decompose the uric acid exposed to its influence, and the potassa evolved at the negative electrode would dissolve it; so that a uric-acid calculus placed between them would be disintegrated at both points. The battery employed was from five to twenty pairs of Grove's plates. From two to nine grains of uric-acid calculus were dissolved per hour at the temperature of the body; of oxalate of lime, half a grain to two grains per hour only were dissolved—the action was four times as slow as upon uric-acid calculi; of oxalate of lime and uric acid in alternating layers, four and a half to five grains were dissolved per hour; of phosphatic calculi, upwards of twenty-five grains were dissolved per hour. Dr. L. Melicher (*Oester. Medic. Jahrbuch*, 1848, vol. i. p. 154) tried to dissolve a calculus by the aid of electricity; it is stated that two experiments on the living body were successful.

Gruithuisen, in 1823, suggested the dissolution of stone by means of the galvanic pile, but no experiment has been made on man.

The removal of a calculus by mechanical means without the use of the knife is confined to a certain class of cases. In the early stage, when the calculus is small, we may assist nature in its expulsion from the bladder by administering alkaline purges, by dilating the urethra with a large bougie, and giving diuretics; the bladder should be allowed to retain as much urine as possible, and then a free and copious evacuation may carry the stone along with it. Should the calculus become lodged in the urethra, it may be extracted by means of forceps, such as described and used by Hunter, Civiale, Sir A. Cooper, and others.

In females this plan is very practicable, and we shall refer further on to it.

The removal of calculi by lithotrity, together with the arguments in favour of this proceeding, will be the subject of special consideration in the next essay.

We now come to the extraction of a calculus by means of an artificial external opening, a necessary operation when lithotrity is deemed unadvisable. This operation is termed lithotomy. There are three situations in which it may be performed, viz. in the perineum, in the hypogastric or

size, or entirely dissolved, by injecting a weak solution of nitric acid, two to two and a half minims of strong acid to the ounce of distilled water.

Dr. Hoskins employed a weak solution of acetate of lead (gr. j. ad ʒj.) with a mere trace of free acid. With a phosphatic stone double decomposition occurs; phosphate of lead, in the form of a fine granular precipitate, and an acetate of lime and magnesia are formed.

pra-pubic region, and through the rectum; each of which will have to be considered.

1. *Perineal lithotomy*. There are several methods by which we may remove a stone from the bladder through the perineum; but we shall at present only refer to the ordinary lateral operation, leaving the other modes to be described as attempted improvements thereon. The necessary requirements of the operation consist in having a firm, solid table, of sufficient height to bring the perineum in a line with the operator's face, he being seated upon a stool sufficiently low to suit the height of the table; the table should be narrow, as to enable the assistants to have more complete command of the patient. Two rollers or bandages should be at hand for securing the proper position of the extremities, and a roller or neck ligature is sometimes used by some surgeons. The instruments employed are the following: a staff, which is to act as a guide or conductor for the knife to enter the bladder; it varies in length and size, according to the age of the patient, and consists of a grooved steel sound, curved like the ordinary catheter, the groove being deeply made on the twixt the lateral and convex aspects, and terminating within a quarter of an inch of the extremity, so as to prevent any further onward movement of the knife. The staff has been modified in shape, with the hope of facilitating the operation; thus Aston Key suggested and used a straight staff, which has been and is still employed by all the Surgeons of Guy's Hospital; it is nothing more than a very long director, slightly bent at its extremity, having the groove placed in the median line. The knife also varies in shape and size, according to the operator's fancy; some use a common scalpel for the first part of the operation, and then it is exchanged for a button-pointed bistoury, to complete the section. Liston performed the whole operation with a common sharp-pointed, scalpel-shaped bistoury; and Key did the same, but his knife was slightly convex on the back near the point; it was longer in the blade than an ordinary scalpel, but about the same breadth. The knife used in children is to be of smaller and narrower dimensions, but not to any great extent. A probe-pointed bistoury is likewise necessary, should any subsequent enlargement of the section be requisite.

Again, some experienced lithotomists, and especially those of early days, prefer completing the operation with an instrument called a gorget; this is a broad wedge-shaped instrument, either *blunted* at the point and sides, or *sharp and cutting*; although in occasional use, it is seldom had recourse to nowadays,—excepting it may be the blunt one, in cases of very deep perineum and of enlarged prostate,—the Surgeon preferring to make his requisite incisions to certain, instead of uncertain measurements. The forceps are of different sizes and shapes, to suit every variety of difficulty; ordinarily they are straight, and the blades so constructed as to allow of an oval space between them when closed, in order that the calculus, when seized, may not be crushed in the efforts at extraction; some are curved, so as to seize the stone should it be engaged in the upper part of the bladder, or fallen into a pouch behind an enlarged prostate, or encysted elsewhere. In children, a pair of common dressing forceps, somewhat lengthened in the handle, will answer all purposes. A scoop is likewise necessary, and proves at times an invaluable instrument; it is chiefly employed in levering out fragments, when a stone from its friability has crumbled to pieces; but it is also of great assistance when the stone is small and eludes the forceps, and on its introduction, together with the aid of the finger, the stone may be readily drawn out by a kind of leverage of the scoop and finger in opposite directions. In Russia a kind of spoon is used in almost all cases, and with great success and ease. A sponge and tube should likewise be within reach, in case it is necessary to wash out the bladder. A female staff and sound is sometimes needed; and a strong lithotrite or crushing forceps, for facilitating the extraction of a large one.

In all cases having to undergo lithotomy, certain preliminary precautions have to be attended to, which may materially influence a successful issue. I have paid great attention to this point, but Liston was not an advocate of too

much preparation. The secretions and excretions, if at fault, should be corrected by appropriate remedies, and the nervous system quieted by anodynes; the urine, especially, should be rendered as healthy as possible, by acids or alkalies, as suits the individual case; sometimes, however, the suffering is so intense that immediate operation is indispensable. It is highly necessary to have an empty rectum; hence it is usual to prescribe a mild purgative powder overnight, to be followed in the morning by an enema of castor-oil, taking care that a free evacuation takes place before operating. Some, as Coulson, prefer giving two enemata, the one to be administered three hours previous to the operation, and to consist of gruel, olive-oil, and salt; the second to be employed about one hour before the time, and to be composed of gruel, with the addition of twenty drops of tincture of opium. The perineum should be shaved if necessary.

The patient is placed upon the table, and chloroform administered; notwithstanding its depreciation by some lithotomists, it materially facilitates the operation, and its effects have not been found in any way to interfere with a successful result.

Four assistants are required besides the administrator of chloroform, viz. one for each side, so as to hold the patient in position, a third to take charge of the staff, and a fourth to assist the operator, in handing the instruments, &c. When under the influence of chloroform, the patient is placed and fixed in the proper position so as to expose the perineum to its fullest extent, and in an entirely perpendicular direction. This is done by flexing the knee and hip joints to such a degree that the patient's hands may be made to grasp the foot, when they are to be firmly secured by a well-adapted figure-of-8 bandage over hand, foot, and ankle; the knees are now widely separated, and each held by an assistant, encircling it with his proximate forearm and hand, and embracing and drawing the foot outwards with the other hand, and thus steadily maintaining the proper position until the completion of the operation. The shoulders and chest have to be raised to the requisite extent, and the patient then to be slid along to the edge of the table. Some use a neck ligature, which passes under both knees and around the neck, but it is at present generally dispensed with. Some Surgeons do not tie up their patients, but use a kind of table with upright props on either side of the lower end, which are connected by a transverse bar; over this the patient's legs are placed, and there maintained in position. This table is so made as to suit all cases. Lately, padded leather bracelets, fixed by hooks to firm leather anklets, have been recommended and used. Children need not be tied up.

The patient being now in an accurate position, the Surgeon introduces the staff into the bladder: this is to be done in the same way as an ordinary catheter, whatever shape the instrument may be. Some introduce it before the patient is tied up, as being more easy; but this plan has the drawback of causing the escape of urine during the subsequent process. Again, the orifice of the urethra may be narrow, which is to be rectified by enlargement with a bistoury. The staff should always be of as large a size as the urethra will permit, but not of too great a size, as it may tear the urethra. It should always be made to strike the stone, and left in contact with it. When stricture exists with stone, the former should be rigorously attended to before proceeding to operate. Care must be taken not to mistake the promontory of the sacrum for a stone in sounding. We shall now give an account of the ordinary lateral operation with the curved staff.

A curved staff, of sufficient calibre and grooved deeply between the lateral and convex surfaces, is introduced into the bladder, and the end made to rest upon the stone; this is intrusted to an assistant to maintain *in situ* as delivered to him by the Surgeon from first to last, with instructions not to depress the handle as the knife enters the bladder. Some Surgeons prefer making the convexity of the staff to bulge in the perineum, so as to be more readily felt; others, as Liston, require it to be hooked against the symphysis, as a more steady security. The Surgeon's left hand is thus left at liberty throughout the whole operation to guide the knife, guard important parts, &c. &c.

The operator proceeds with the first step of the operation, viz. to lay bare the groove of the staff by an oblique perineal incision ; and this of course requires careful previous anatomical knowledge of the neighbouring parts, and the course the knife ought to take to escape important structures, such as the bulb and its artery above, the rectum in the median line, and the internal pudic vessels to the outside. There is the raphé in the median line, succeeded by the anal aperture, and on either side the ramus and tuberosity of the ischium, leaving an intermediate triangular space almost free from danger. The point of commencement is a little to the left of the median line, at a variable distance in front of the anus, and the incision is to be carried obliquely downwards and outwards midway between the anus and tuber ischii to the extent of 3 to $3\frac{1}{2}$ inches. Some discrepancy exists as to the exact spot of commencing : thus Cheselden, Keith, and Crichton, all of whom have been remarkably successful, recommend 1 inch in front of the anus ; Brodie, Stanley, and Skey, about $1\frac{1}{4}$ inches in front ; Fergusson and others $1\frac{3}{4}$ inches. All these measurements refer to the adult perineum. The best practical directing is to commence about midway between the anus and scrotum.

The knife is plunged freely into the perineum and carried downwards and outwards, dividing the skin and superficial fascia, as also the transverse perineal muscle and its artery, and some fibres of the levator ani muscle, laying open the perineal triangle and ischio-rectal space. The forefinger of the left hand is then introduced into the wound through the loose cellular tissue to gain the groove of the staff behind the bulb, and just anterior to the resisting deep fascia, when the point of the knife, being slipped along the nail of the finger and thus guided by it, is made to enter the groove at this spot, viz. the membranous portion of the urethra. The left forefinger can also be used to depress and protect the rectum.

The second step is the deeper section, which is effected by carrying the knife along the groove of the staff through the deep fascia, the membranous portion of the urethra, with its muscles, the left lobe of the prostate gland, and a small portion of the neck of the bladder. This is done by maintaining the left forefinger still in the groove, and making perfectly sure that the knife is securely within it ; then, by a slight movement of the right hand, the knife is lateralised so as to correspond to the direction of the external wound, and steadily pushed onwards, until a feeling of loss of resistance or a gush of urine takes place. This is one of the most important parts of the operation, namely, the mode and extent of dividing the prostate gland ; and no Surgeon should undertake the performance of lateral lithotomy in the adult without a due knowledge of the size, shape, and condition of the organ, and its relation with such vital surrounding structures, as the recto-vesical fascia and peritoneum, the great object being to have a sufficient opening to allow of the passage of the finger, without bruising or tearing the parts. Some Surgeons recommend small incisions and subsequent dilatation ; others make a free section corresponding to the size of the stone, without regard of exceeding the limits of the gland. Liston is very minute and particular on this point.*

* "This internal incision must be very limited indeed ; it should certainly not extend beyond six or seven lines from the urethra outwards and downwards ; for the less that is cut, the greater will be the patient's safety." At p. 510 (op. cit.) he introduces a sketch "to show what is indispensable to cut :—it is a section of the dense, unyielding, fibrous tissue at the base and in front of the gland into which the muscular fibres are inserted ; it appears as a white triangular band, effectually preventing dilatation or enlargement of the orifice of the bladder beyond a certain and very limited extent, without laceration, dreadful suffering, and imminent danger. The incision required to divide this need not pass very far from the groove of the staff ; and if that is effected, the dilatation can be carried to any required extent. The object in following this method is to avoid all interference with the reflexion of the ilio-vesical fascia, from the sides of the pelvic cavity over the base of the gland and side of the bladder. If this natural boundary betwixt the external and internal cellular tissue is broken up, there is scarcely a possibility of preventing infiltration

The third step is the introduction of the forceps and the removal of the stone. Now, although the second proceeding is one of the utmost delicacy and moment, the present far excels it in difficulty of execution, and is often the cause of the delay and trouble witnessed in lithotomy. The knife having been withdrawn, the left forefinger is carried on along the staff into the bladder; and on feeling the stone, the sound may be removed; the Surgeon now ascertains its position and size, and then proceeds with a suitable pair of forceps to seize and extract the calculus. The forceps are introduced shut, and guided by the finger into the bladder, the handles being gently raised so as to gain the fundus of the bladder, when the blades may be separated, one of which is to be made to slip under the calculus, and the instrument then closed upon the stone. The point is then gently raised, by depressing the handles, so as to bring it towards the external incision, when extraction is to be made in the direction of the axis of the pelvis slowly and deliberately; the instrument is moved forwards and backwards gently, so as to dilate the parts, and these are pushed back, as it were upon the stone, by the finger of the left hand, whilst the extracting force is kept up.

After the removal of the calculus, the finger must again be introduced into the bladder, so as to ascertain the existence or presence of any other stone; and if the perineum be very deep, a searcher or sound may be passed.

Lateral lithotomy with the straight staff was first introduced by Aston Key at Guy's Hospital, where it is still used by the Surgeons. It has its advantages and disadvantages; but upon the whole the straight is as satisfactory an instrument for a guide into the bladder as the curved staff. Of course some little modification in the mode of conducting the operation is required, although the steps are almost precisely the same as in the foregoing operation, viz. to open the perineum and urethra, to open the bladder, and to extract the stone.

The operator with the straight staff must bear in mind, in the first place, that it is more liable to be tilted out of the bladder than the curved one; hence the Surgeon is always very careful to ascertain that the end of the staff rests on the calculus previous to his commencing the incision. Again, it is also not so easily introduced along the urethra into the bladder when the patient is placed in the position for operation; but this difficulty is readily overcome by the practised operator. During the first step of the operation with a straight staff, there is generally a twofold or subdivided proceeding, viz. laying open the perineum first of all, and then laying open the urethra. This is necessary with the straight staff, as the membranous portion of the urethra is placed at a very great depth, and any attempt to enter the urethra early would involve the bulb and its artery. This is the chief objection to the use of this instrument. Thus, then, in the first incision the integuments and superficial fascia are cut through, and the knife made to traverse the transversus perinei muscle and fibres of the levator ani, giving a good external opening; the next point is to pass the forefinger of the left hand through the loose cellular tissue in the triangular space until it impinges upon the staff beyond the bulb, necessitating a much longer track than with the curved staff. The bulb is now protected, and the knife made to enter the membranous portion of the urethra; this must be thoroughly and unquestionably exposed: a point on which the success of the operation entirely depends.

The Surgeon, while maintaining the knife in the groove of the staff, with-

of urine, which must almost certainly prove fatal. The prostate and other parts around the neck of the bladder are very elastic and yielding, so that, without much solution of their continuity and without the least laceration, the opening can be so dilated as to admit the forefinger readily; through the same wound the forceps can be introduced upon this as a guide; and they can also be removed, along with a stone of considerable dimensions, say from three to nearly five inches in circumference in one direction, and from four to six in the largest."

draws the left finger, and now takes charge of the staff from the assistant with his left hand; then depressing the handle and bringing it parallel with the axis of the pelvis, thus presenting a direct passage to the bladder, he lateralises both staff and knife simultaneously to the left side of the patient, so as to correspond to the external incision, and carries the knife onwards to the bladder, regulating the section of the prostate at the same time, or on its withdrawal. Key's knife has a double convex extremity; hence great caution is required to keep the point upwards in the groove of the staff at an angle of 45° : for if the staff and knife be held too parallel to each other, the upper convex border of the latter will be tilted out of the groove just anterior to the prostate, and instead of entering the bladder, it will pass into the pelvic cavity. The third step consists in laying the knife aside, and transferring the staff to the right hand, so that the left forefinger may be introduced into this wound, and guided by the staff into the bladder, so as to feel the stone, and when satisfied of its presence, maintaining it there *in situ*, while withdrawing the staff. The forceps is now introduced along the finger, and the operation of extraction proceeded with as already detailed.

After the removal of the stone, provided no casualties or difficulties have occurred, some experienced operators recommend the introduction of a gum elastic tube through the wound into the bladder, where it is to be secured properly by tapes: this is left in, in children, for twenty-four hours; and in adults, for forty-eight hours. Liston says, "It is especially adopted in the aged;" and he attributes much of his success to its employment, "as it occasions no inconvenience, and affords great facility for arresting any oozing that may arise from the vessels." In general, however, it is dispensed with.

The patient is unbound, carried to bed, and laid on his back, with his body raised and his knees bent over a pillow, with the pelvis resting upon a draw-sheet; so that the latter may be drawn away at intervals, as the urine saturates the sheet.

Some Surgeons, as Crichton, recommend immediate closure of the wound, in order to gain union by the first intention. Some cases have succeeded well, but others have been followed by severe inflammatory symptoms: hence, as a rule, it is not advisable or justifiable to adopt this measure.

Little or no medical treatment is required, except, perhaps, the exhibition of opium when there is great restlessness; and where the bowels are not relieved within six days, a castor-oil enema, carefully given, will be sufficient.

Before advertng to the several varieties of operative measures suggested in lieu of lateral lithotomy, for removing and remedying the defects and difficulties which are encountered in that operation, and for correcting its faults, if there be any, let us carefully survey the several accidents and difficulties, as well as the causes of death, which are generally met with.

With regard to the passing of the staff, great attention and care must be paid to its use in children, as a false passage is readily made, so that the instrument enters the pelvis below the bladder instead of passing into it; and in some rare instances unusual force has separated the urethra from the prostate. Hence we are never to operate unless the staff is left in contact with the stone. In children prolapse of the rectum is also very frequent; the gut must be returned, and the sphincter allowed to contract, before operating. The presence of the cicatrix of a former operation need not interfere with a second or even a third incision in the same situation. On several occasions at Guy's Hospital lithotomy has been performed on the same patient two or three times along the original seat of incision, and without difficulty.* Some recommend fresh incisions to be made on the right side of the perineum, should there be much induration and rigidity, with fistulous abscesses and sinuous tracks; or the Surgeon may dilate, if possible, the original opening, cutting

* On this subject see *infra* the table of cases of relapse of stone occurring at the Norfolk and Norwich Hospital, with remarks by Mr. C. Williams, p. 463.

on the finger among the altered structures, guided of course by a staff in the urethra. If a perineal hernia exists, it may be cut into; but these cases are exceedingly rare, and the accident is scarcely to be avoided.

Enlarged superficial vessels, or the transverse perineal artery, may be wounded and bleed, but are readily tied, if necessary; with care and due attention the bulb and its artery ought not to be injured (except in cases of very deep perineum), and the accident is mainly due to too great haste and anxiety to enter the groove of the staff early: when the bulb or its artery has been wounded, it is best to proceed with the operation, and endeavour to secure the bleeding vessel afterwards, by means of the tenaculum, or compressing forceps: of course if the hæmorrhage be violent, the vessel must be secured without delay.

During the second step, several serious accidents may arise; for if the knife be carried too much outwards, under the ramus of the pubes, the pudic artery may be wounded; or if carried too much inwards, with a full rectum and prolapsus of the organ, that tube may be involved; and, lastly, which is by far the most important point, there may be too great or too little section of the prostate gland, and wound of the prostatic plexus of veins. In wounds of the internal pudic artery, it is best to request an assistant to compress the artery against the pubes, and to complete the operation of extraction, when the artery may be attempted to be secured by ligature; should this fail, a short gum catheter, around which some oil-silk is fixed, like to an umbrella, is to be introduced into the wound, and the space between it and the catheter plugged with lint, cotton, or charpie; this is the *canule à chemise* of Dupuytren. Sometimes there is an unusual distribution of vessels: but the case must be treated in the same manner. Where there is general oozing and venous hæmorrhage, cold water and ice to the perineum and above the pubes are useful.

The wounding of the rectum has occurred to some of our best operators, during the struggling of the patient, when chloroform was not in vogue; sloughing of the rectum from bruise and injury during the extraction of a large stone has also taken place. The urine will flow in part by the rectum, and a natural cure cannot readily take place. The earlier the sphincter is divided, as for the cure of complete fistula in ano, the better will be the patient's chance of being freed from an annoyance.

With regard to the section of the prostate gland, much weight is attached to the amount of its division in adults; whereas in infants and young children there is no such fear, as the gland is but rudimentary. Mr. Thompson (op. cit.) remarks, that "the prostate is so exceedingly small as to be almost always, if not invariably, cut wholly through in lateral lithotomy, yet without the occurrence of any accident. Indeed, it is not possible that either forceps or finger can pass into the bladder unless the incision exceeds the thickness of the organ." Again, in children a difficulty may arise from the staff having escaped from the urethra by a false passage, so that the knife cannot be guided into the bladder; or the urethra may be separated from the prostate; or again, the bladder may recede before the point of the knife: in the two former cases the staff must be partially withdrawn and manipulated, so as to reach the bladder by the natural passage, and a grooved director introduced through the wound may sometimes be passed. When the bladder recedes before the knife, so that the finger cannot be made to enter the viscus, Liston suggests the use of a searcher, whereby he would pull the opening of the bladder, as it were, down upon the finger; should, however, it be possible to introduce the bent first joint of the finger, the bladder can be pulled down and the stone felt. In the adult, the section should never exceed the external limits of the prostate; this has already been alluded to. Sometimes the patient is remarkably corpulent, and has a deep fatty perineum, and probably also an enlarged and rigid prostate and a receding bladder, making a very long space to be traversed, so that there is difficulty in making the internal opening freely, and the finger will scarcely reach the prostate; in such cases, a probe-pointed knife may be introduced to complete the section,—a lithotome may be used; but by far the most judicious proceeding is the intro-

duction of a blunt gorget, carefully directed onwards to the bladder, and not allowed to escape from the staff: in fact, the gorget used formerly to be, and is sometimes now, employed in completing the ordinary lateral operation. An hypertrophied prostate, or one deformed by tumour, may give rise to difficulties; so may also a deformed pelvis.

Respecting the difficulties encountered in the extraction of stone, they are almost innumerable, and must be met according to circumstances; a few of these we shall just allude to. In cases of large calculi, Liston (*op. cit.*) maintains that "the single lateral incision affords sufficient room for removal of the stone in nineteen cases out of twenty; and there can be no purpose served, therefore, in always making a cut in both sides of the gland, and thus endangering the emasculation of the individual." He again, however, observes: "Should it be impossible to bring it through an opening on one side of the prostate, such as described, without bruising and laceration of the parts, it will then be proper to provide more room for its exit; and this is gained by making the incision on the opposite side of the neck of the bladder. This is done by passing a narrow-bladed and blunt-pointed bistoury along the finger, and directing its edge towards the right tuberosity of the ischium. If the external incision has been well planned, properly made, and of sufficient extent and low in the perineum, there is no occasion for any further division of the skin and superficial parts. No complicated machine is required to make this bilateral division, and it is quite time enough to have recourse to the proceeding when the necessity has been fully ascertained to exist."

Martineau* remarks, that "should the stone be large, or there be any difficulty in the extraction, rather than use much force while the forceps have firm hold of the stone, I give the handle to an assistant while the part forming the stricture is cut, which is easily done, as the broad part of the blade becomes a director to the knife; and rather than lacerate, I have often repeated this enlargement of the inner wound two or three times." Some Surgeons, more especially recently, have recommended the crushing and breaking up of a large calculus by a lithotrite, or strong crushing forceps, or cutting it in two by appropriate instruments, and then extracting. This has been performed successfully; but great danger and risk is necessarily incurred, for the bladder is generally firmly contracted on the stone, so that the coats and mucous membrane can hardly escape injury. Where it is so large, and the above measures fail, recourse must be had to the recto-vesical or supra-pubic operation. Where the stone is soft and friable, or brittle, crumbling to pieces under the application of the forceps, much of it may be removed therewith, and the rest evacuated by the scoop. The washing out of the bladder with warm water, by means of a syringe and tube, is highly useful, and attended with excellent results, in detaching any débris or concretion from the walls of the bladder without injury.

When the calculus assumes an elongated form, or any unusual shape, careful manipulation with the finger and forceps may shift it into such a favourable position as to allow of its extraction. Where there is much spasm of the bladder, and a kind of hour-glass contraction, it is best to wait a few moments until it has subsided, and then carefully coax the forceps between the calculus and the walls, gentleness and patience being the chief treatment. Sometimes a stone is caught in the upper part of the bladder, and can almost be felt above the pelvis; by gentle pressure in the hypogastric region, it may be made to descend so as to be seized with the forceps. Encysted calculi often give an infinite deal of trouble, and sometimes will defy all efforts at extraction. In extracting phosphatic calculi, the operator must be on his guard, and recollect that sometimes calcareous matter is firmly deposited on the mucous membrane, and any attempt to remove it by the forceps will only tear away the tissue with it. Another point, which is alluded to by Mr. Thompson, is, that sometimes in elderly patients portions of the prostate gland have been

* *Med.-Chir. Trans.* vol. ii. p. 411.

removed by laceration, such as the small rounded tumours in the substance of the organ, and the pedunculated growths met with in this situation.

Before proceeding to the question of mortality after lateral lithotomy, we will just allude to the complications which may ensue, although the patient has made a good recovery; thus, the wound may not entirely close, and leave a urinary fistula, which must be treated as other urinary fistulæ; incontinence of urine may result, either temporary or permanent. It is not very common, and mostly met with in children, and cured by attention to the passing of the urine and the general health; as age advances, it generally passes off. Key* remarks, that "in the young subject partial incontinence will sometimes occur, if the patient is allowed to leave his bed too soon after the operation, before the neck of the bladder is firmly healed and the sphincter has recovered its tone." Impotency, from injury done to the ducts and vesiculæ seminales, is very rare, and is irremediable. Fæcal fistula sometimes follows, either from the effects of the knife, or from sloughing consequent upon bruising of the rectum during the extraction of the stone.

The causes of death after lateral lithotomy are the following:

1. Death from the shock of the operation, without any discoverable lesion, may occur, as in any of the ordinary operations; it is very unfrequent, generally occurring in old people, and sometimes in children; it seems to depend upon some peculiar condition of constitution and nervous system.

2. Death from chloroform may likewise occur, and the same remarks as just made about shock apply to these cases. Lithotomy in nowise militates against the use of anæsthetics.

3. Death from hæmorrhage and exhaustion may ensue either primarily immediately after the operation, or secondarily some days after, from separation of the plug of coagulum in the wounded vessel, or separation of a slough from a bruised vessel, or the extension of a sloughing wound involving the vessels. Death from primary hæmorrhage rarely occurs, and although children can little stand any great amount of loss of blood, yet we sometimes see them rally after having been thoroughly blanched and in an apparently hopeless condition. Liston states that the average is about 1 death in 100 cases of death; M. Begin affirms that it is the cause of death in 1 out of every 4 deaths; but this is not so in this country. Although primary and secondary hæmorrhage may not *per se* cause death, yet it will so act as to cause great constitutional depression and debility, and consequently prevent the reparative process, and lay the foundation for general decline, or place the patient in a condition favourable for pyæmia.

4. Death from pelvic cellulitis is by far the most frequent in adults. It consists in an acute inflammation of the tissues around the outside of the bladder, more especially the neck, base, and sides; and is generally produced by urinary infiltration into the cellular tissue of the pelvis. Some consider it to be due to too great a section of the prostate, involving the deep pelvic fascia, and allowing the urine to pass directly into the cellular tissue, and thus cause the inflammation; others maintain that the infiltration of the urine is not a mechanical process, but generally follows inflammatory action, and that this inflammation is due to mechanical violence inflicted in removal of the stone from insufficient section of the gland. In some instances death has taken place from cellulitis, quite independent of urinary extravasation. This inflammation may extend by contiguity to the peritoneum, inducing peritonitis; but it generally leads to purulent infiltration, deposits of pus, and pyæmia. The symptoms are those of severe constitutional irritation, attended with rigors, great prostration and anxiety, and soon followed by symptoms of low typhoid fever; the wound assuming an unhealthy aspect, and giving exit to a fetid discharge.

5. Death from acute peritonitis (*per se*) is rare, seldom occurring in adults. but now and then in children where the anatomical position of the bladder is

* *Guy's Hospital Reports*, vol. ii. p. 25.

closer to the peritoneum, so that too large a section of the neck and base of the bladder may involve it. Peritonitis used formerly to be considered as the most frequent cause of death after lithotomy, but subsequent investigations have disproved this.

6. Death from acute inflammation of the mucous membrane of the bladder (cystitis), extending to the kidney or peritoneum, is also rare, although Boyer has asserted it to be the cause of three-fourths of the deaths; this is not the case.

7. Death from inflammation of the prostatic veins (phlebitis) and its effects is not unfrequent, and generally occurs in persons of advanced life; the disease does not often set in until after a week or a fortnight, when recovery is hopefully anticipated.

8. Death from pyelitis, or inflammation of the kidney, or suppuration of the kidney, has been also occasionally met with; and at the post-mortem examination the advanced state of the disease has given evidence of its having existed long prior to the operation.

9. Death may also occur from absorption of the products from the urine, thus poisoning the blood and causing rapid death.

Erysipelas, diarrhœa, fever, or any other accidental attack, may render the operation fatal.

Many statistical inquiries have been made respecting the mortality after the lateral operation of lithotomy. These have been recorded by Crosse, Civiale, South, Coulson, and others, to whose works we must refer those of our readers anxious to investigate the subject. For the most part, these statistics cannot be relied upon as offering any direct assistance, except so far as a general survey, in estimating the value of the operation: they comprise compilations, selections, and returns, in which are many faults of omission and commission. This has been alluded to by Mr. Henry Thompson (op. cit.), who has attempted to lay before the profession a more correct table, and this table may be used as a tolerably complete epitome of the mortality of lithotomy under British Surgeons: it is derived from reliable sources, mentioned in the text of his work, and contains 1827 cases.

Mortality rates at all ages in 1827 cases of lateral operation, in metropolitan and provincial hospitals.

	Cases.	Deaths.	Cases.
Norwich (Crosse).	669	91	about 1 in $7\frac{1}{2}$
Since that time	124	15	„ 1 in $8\frac{1}{2}$
Oxford	110	14	„ 1 in 8
Leicester	90	8	„ 1 in 11
Leeds	29	4	„ 1 in $7\frac{1}{4}$
Birmingham	102	10	„ 1 in 10
Guy's Hospital	230	33	„ 1 in 7
St. Thomas's Hospital	200	29	„ 1 in 7
University College Hospital	90	12	„ 1 in $7\frac{1}{2}$
Cambridge	183	13	„ 1 in 14
	1827	229	nearly 1 in 8

Some have based the rate of mortality on the weight of the stone (see Crosse), and have drawn a conclusion that the mortality increases in nearly the same ratio as the weight.

Others, and perhaps with more reason and practical tendency, have considered the mortality in proportion to the different ages of the patients. This also has been done by Mr. Thompson in the following table. Still even this method is open to objection, inasmuch as a stone may have been formed in the bladder and have remained there a long time previous to the operation.

Mortality rates at different ages.

During the years	Cases.	Deaths.	Cases.
1 to 5 inclusive	473	33	or about 1 in $14\frac{1}{2}$
6 to 11 "	377	16	" 1 in $23\frac{1}{2}$
12 to 16 "	178	19	" 1 in $9\frac{1}{2}$
17 to 20 "	76	11	" 1 in 7
21 to 29 "	86	11	" 1 in 8
30 to 38 "	75	7	" 1 in $10\frac{1}{2}$
39 to 48 "	100	17	" 1 in 6
49 to 58 "	191	40	" 1 in $4\frac{3}{4}$
59 to 70 "	233	63	" 1 in $3\frac{3}{4}$
71 to 81 "	38	12	" 1 in $3\frac{1}{6}$
	1827	229	

We have taken the liberty to make a slight modification of the above, so as, if possible, to show the mortality at the different epochs of life, which may guide us in some measure ; but it is somewhat arbitrary :

Mortality rates at different epochs of life.

	Cases.	Deaths.	Cases.
1 to 5, infancy and childhood, 473 cases, 33 deaths, about 1 in $14\frac{1}{2}$ cases	850	49	about 1 in $17\frac{1}{3}$
6 to 11, boyhood, 377 cases, 16 deaths, about 1 in $23\frac{1}{2}$			
12 to 16, boyhood, with increasing development and setting-in of puberty	178	19	" 1 in $9\frac{1}{2}$
17 to 29, adolescence and manhood	162	22	" 1 in $7\frac{1}{3}$
30 to 48, adults	175	24	" 1 in $7\frac{1}{3}$
49 to 70, advancing life	424	103	" 1 in $4\frac{1}{8}$
71 to 81, advanced life	38	12	" 1 in $3\frac{1}{6}$
	1827	229	avr. nearly 1 in 8

We have here inserted a table drawn up by Mr. C. Williams, comprising the cases operated on at the Norfolk and Norwich Hospital, during a period of ninety years ending December 1862 :

Age	Operations.	Cured.	Died.	Mortality.	Operations.	Cured.	Died.	Mortality.	Operations.	Cured.	Died.	Mortality.				
1 to 10	328	306	22	1 in 14·90	455	421	34	1 in 13·38	574	532	42	1 in 13·6				
10 „ 14	55	53	2	1 „ 27·5												
14 „ 20	72	62	10	1 „ 7·2												
20 „ 30	59	55	4	1 „ 14·75	119	111	8	1 „ 14·87	336	260	76	1 in 4·42				
30 „ 40	60	56	4	1 „ 15												
40 „ 50	58	47	11	1 „ 5·27												
50 „ 60	132	108	24	1 „ 5·5	190	155	35	1 „ 5·42								
60 „ 70	119	87	32	1 „ 3·71												
70 „ 80	27	18	9	1 „ 3					146	105	41	1 „ 3·56				
	910	792	118	1 in 7·71	910	792	118	1 in 7·71					910	792	118	1 in 7·71

869 were males, of whom 811 were operated on by the lateral method, with a mortality of 105 ; 41 by the median section, with death in 11 cases ; and 17 were lithotritised : 41 were females, of whom 2 died.

Table of cases that underwent Lithotomy a second time at the Norfolk and Norwich Hospital: it is intended to show the age in years of each patient at the time of his being first operated on, the interval in months between the first and second operation, the weight of the calculus removed, the result, and some observations on the general character of the calculi.

By C. WILLIAMS, Esq., House Surgeon, Norfolk and Norwich Hospital.

No.	Age at 1st operation.	Interval between 1st and 2d operation.	Weight of calculi.		Result.	OBSERVATIONS.
			1st operation.	2d operation.		
1	15	16 months	5ij	5j	cured	Three phosphatic calculi removed at the first operation broken into many fragments; the calculus taken away at the second operation was of the same description.
2	48	12 "	5ij	3v	cured	One flat lithic acid calculus first removed entire; the stone removed at the second operation was of the same consistence.
3	37	46 "	2v	5ijss	cured	One perfect phosphatic calculus at first operation; also one of same composition at the second.
4	38	74 "	3j	5iv	died	One entire lithic-acid calculus at first operation; a phosphatic one at the second.
5	24	24 "	5ij	5vj	cured	Phosphatic calculus, broken into fragments, removed at the first operation; the same on the second occasion.
6	63	32 "	5iv	5ij	cured	One entire flat lithic-acid stone at first operation; also one unbroken flat lithic-acid calculus at the second operation. Had stone a <i>third time</i> , and was deemed unfit for operation.
7	2½	15 "	3ijss	5j	cured	The first calculus phosphatic, and broken in the extraction; the second likewise phosphatic, and broken.
8	55	142 "	3jss	5ij	died	The first was a large, oval, unbroken, uric-acid stone; second was of same form and composition.
9	3½	24 "	5ijss	5ij 3ij	cured	The first calculus was entire and phosphatic; the second likewise phosphatic and unbroken.
10	8	17 "	5ij 3j	5ivss	cured	One entire lithic-acid calculus removed at the first operation, which left a recto-vesical fistula; the second calculus was an unbroken phosphatic one.
11	3	14 "	6 grs.	5ijss	cured	One small oxalate of lime removed entire at first operation, and a mixed one at the second.
12	7	24 "	5jss	3ij	cured	A perfect oxalate-of-lime stone taken away on first occasion; a phosphatic one on second.
13	18	8 "	5vj	5ivss	cured	One phosphatic calculus, broken into four fragments, taken away at first; and one of the same composition at the second.
14	46	12 "	5xss	3iv	died	One large entire lithic-acid calculus removed at the first operation; during which the rectum was wounded: and a recto-vesical fistula was present when the second was performed, on which occasion a phosphatic stone was taken away.
15	60	111 "	5iv 3ij	5ij 3v	died	The first calculus was a very perfect lithic acid; the second, a large <i>urethro-vesical</i> lithic-acid stone: symptoms of recurrence of stone came on three years after the first operation, and lithotomy was resorted to, and subsequently lithotomy.

(Table continued from preceding page.)

No.	Age at 1st operation.	Interval between 1st and 2d operation.	Weight of calculi.		Result.	OBSERVATIONS.
			1st operation.	2d operation.		
16	62	70 months	3iv	6 grs.	died	One entire and two broken lithic-acid calculi removed on first operation; a small angular stone at the second, on which occasion median lithotomy was resorted to.
17	7	16 "	5ij	5ij 3j	cured	This patient was <i>lithotomised a third time</i> , at an interval of eleven months from the second; two entire lithic-acid stones were removed at the first operation; a phosphatic one, slightly broken, at the second; and a perfect oblong phosphatic one at the third.
18	34	16 "	3j 3v	5j 3j	cured	An entire lithic-acid stone, capped with a thin layer of phosphate, at the first operation; was <i>lithotritised</i> on the second occasion; the debris consisting of phosphates.*
19	61	30 "	5iv	5j 3ij	cured	This man had undergone lithotripsy twice previous to the first lithotomy, at an interval of 28 months between each; an interval of 13 months existed between the last lithotripsy and the first lithotomy. The debris after lithotripsy consisted principally of uric acid and phosphates; several phosphatic calculi, many of them broken, were removed at the first lithotomy, as well as at the second; a perineal fistula remained after the former, which was not cured even after the second; on which occasion the median method was adopted.
20	69	9 "	5ij 3ij	3ijss	cured	Was <i>lithotomised a third time</i> , at an interval of thirty-four months from the second; several small phosphatic stones taken away at first operation; a perineal fistula present at the second and third operations, which were performed according to the median plan; soft phosphatic calculi removed on both occasions.
21	68	7 "	5ij 3ij	5ij	cured	Five entire and two broken uric-acid calculi came away at the first operation, and two perfect uric-acid ones at the second; on which occasion median lithotomy was performed.
22	59	58 "	5ij	3v	cured	One entire lithic-acid stone at first operation, and one of the same composition at the second.
23	31	22 "	5j	5ij 3ij	cured	First calculus (a mixed one) perfect; an encysted stone left undiscovered, which was removed at the second operation, together with one lying loose in the bladder; median lithotomy performed on second occasion.
24	66	4 "	3j	5ij 3ij	cured	A broken lithic-acid stone at first operation, and five capped with phosphates removed at the second; median lithotomy resorted to in both instances; a perineal fistula resulted from the first, which was cured by the second operation.

Two cases that underwent lithotripsy on the first occasion, and lithotomy on the second.

25	54	20 "	5ij x grs.	3j 3ij	cured	The detritus at the first operation consisted of phosphate and lithate mixed; at the second the calculus was made up entirely of phosphates.
26	55	30 "	3v	5ij	died	The debris removed in the first instance was composed of uric acid, whereas at the second operation it consisted of urates and phosphates.

Remarks by Mr. C. Williams. From the opening of the Norfolk and Norwich Hospital, in 1772, to November 1863, there have been admitted 923 cases of stone in the bladder, and these have undergone some form of operation for the removal of the complaint; 24 of this number suffered a relapse, and underwent a second operation. The proportion that such cases bear to the whole number of stone-patients is 1 in 38·45.

The two cases (Nos. 25, 26) on whom lithotrity was first performed, and subsequently lithotomy, may be excluded from our consideration, inasmuch as it is very possible that fragments of calculous material were retained in the bladder, and became the nuclei of fresh formations; an occurrence not so likely to happen when lithotomy was resorted to in the first instance.

Our table, then, presents us with 24 cases of recurrence of stone, taken in the order in which they presented themselves at the hospital; of this number, 19 were cured, and 5 died; three had stone a third time, two were cut and recovered, the third was deemed unfit for operation. All the patients were males, no instance having shown itself of recurrence in the female. One patient (No. 19) underwent lithotrity for his second operation, and was successfully cured.

Six of the cases were below 10 years of age; two between 10 and 20; one between 20 and 30; four between 30 and 40; two between 40 and 50; two between 50 and 60; and seven between 60 and 70. One death occurred below 40 years of age, and four above that period of life.

The production of the second calculus took place in six of the cases within one year; in ten within two years; in two within three years; in one within four years; in one within five years; in two within seven years; while in the remaining two cases the operation did not become again necessary until after a lapse respectively of nine and twelve years.

The average period of recurrence in the twenty-four cases was thirty-three months. Lateral lithotomy was adopted in all the patients with the exception of eight, two of which were cut on both occasions by the median plan; and on four that form of operation was resorted to at the second time.

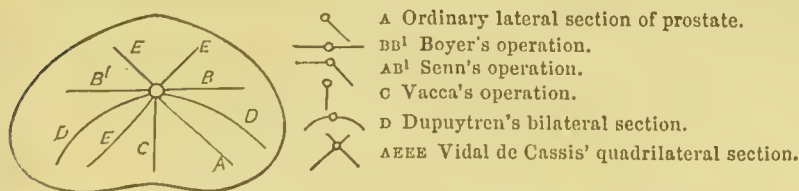
In fourteen the calculi were removed in a perfect and entire condition at the first operation; while in eight the calculi were broken in the extraction; in one the stones were very small and numerous; and in the remaining one a sacculated stone was left undetected in the bladder.

It does not appear that the second calculus is necessarily of the same character in all cases as the first, though in sixteen the second formations were of the same composition as the first; nine being composed of the phosphates, even of lithic acid and the lithates; whilst the phosphates succeeded the lithates in five, and the oxalates in two.

Such are the practical points in connexion with ordinary lateral lithotomy; we shall now cursorily allude to the several other modes of proceeding in the perineal section, as adopted in this country and elsewhere.

1. Lateral lithotomy modified as regards the section of the prostate;—

Vertical section of prostate, showing the various incisions recommended.



Boyer made a transverse incision of the prostate with the lithotome caché, dividing the gland in its greatest diameter (see woodcut, BB'); but the objection to the operation was the division of the perineal vessels, and consequent hæmorrhage. Senn combined the two, by making the ordinary oblique inci-

sion through the left lobe, and the transverse one through the right. (See woodcut, AB¹.)

2. The perineal incision, made in a transverse direction and of a semi-lunar curve in front of the anus. This was advocated by Dupuytren in his well-known bilateral section of the prostate gland in cases of large stone. He divided the tissues towards the symphysis, so as to avoid the rectum, the urethra was opened from above downwards (median) with a double-edged bistoury, and then his curved double lithotome was introduced into the bladder; the blades were then opened and made to cut their way out, dividing the prostate in its oblique diameters. (See woodcut, DD.) The results of this operation gave 19 deaths in 85 cases, or 1 in $4\frac{1}{2}$ cases.

3. *Median lithotomy*, where the incision is made in the central line of the perineum, formerly known as the Marian operation. This comprises two modes of proceeding, viz. with section of the prostate gland, or without section of the gland, by merely opening the urethra, with perhaps partial division and incision of the apex of the organ. Vacca was the first to revive the median operation, and he practised a vertical section of the prostate; but, although there was no fear of hæmorrhage, the rectum was endangered, so that the operation could only be performed when the stone was small and in adult prostates. (See woodcut, C.)

Civiale in 1836 modified this procedure by his medio-bilateral operation. Having made his perineal incision in the median line, he avoided the bulb, and opened the membranous portion of the urethra, when he introduced a straight double-bladed lithotome into the bladder, and by withdrawing it opened, made a transverse section of the gland, as in Boyer's operation.

Buchanan* has further simplified this method by the following mode of proceeding: he uses a rectangular staff, which is one bent at right angles three inches from the point, and having a deep lateral groove, with a posterior opening. The instrument is introduced into the bladder, assisted by the left forefinger in the rectum, and thus the angle made to correspond in situation with the apex of the prostate gland, the lower or grooved branch lying parallel to the rectum. The angle rests on the farthest extremity of the membranous portion of the urethra, so that when the knife is plunged into the groove of the staff the membranous portion escapes all injury. The staff is intrusted to an assistant, and the operator, keeping the left forefinger in the rectum, takes a long straight bistoury, holding it in his right hand with the palm upwards, the blade horizontal, and the edge directed to the left; he then enters the perineum opposite the angle of the staff, and passes the knife straight into and along the groove, as far as the stop at its extremity, into the bladder. Next he withdraws the bistoury slowly, making a lateral section of the prostate, but as he does so cuts outwards and downwards, a distance rather more than equal to about one-fourth of a circle round the upper and left side of the rectum, in which organ his finger still remains: an external wound surrounding the corresponding part of the anus about $1\frac{1}{4}$ inches in length results from the operation. His arguments in favour of this procedure are: 1. the more easy and rapid method of reaching the prostate gland, being only two lines from the surface of the skin, the rectum pressed out of the way and the knife passed straight forwards into the bladder; 2. the membranous portion of the urethra is avoided, and less incision required; 3. all blood-vessels are out of the way, and consequently there is no hæmorrhage; 4. the rectum, notwithstanding its vicinity to the incision, is less likely to be injured; and 5. there is less risk of deep-seated infiltration of urine.

Allarton's† operation is also performed in the median line, but he does not make any section of the prostate gland, except it be but partial, just incising the apex. The ordinary staff is introduced into the bladder, and then the left forefinger passed into the rectum, so as to feel the staff at the prostate: he transfixes with a straight bistoury the perineum in the median line about

* *Edin. Month. Journal*, Feb. 1848.

† *On Median Lithotomy*.

half an inch above the anus, carrying the knife on till it strikes the groove of the staff at the membranous portion in front of the prostate; the urethra is pierced at this spot, and after pushing the knife towards the bladder for a few lines, it is withdrawn, at the same time cutting upwards, dividing the urethra a little, and finishing so as to have an external incision of $\frac{3}{4}$ to $1\frac{1}{2}$ inches. A long ball-pointed probe is then passed into the bladder along the groove of the staff, when the latter is withdrawn, and the left index-finger slid along the probe into the bladder, dilating the prostate and neck of the bladder to the requisite extent, and serving as a guide to the forceps. Where the stone is large he uses Weiss's three-bladed female director, or Arnott's hydraulic director.

In cases of large stone Vidal de Cassis has advised a quadrilateral section of the prostate gland; he says, "no matter what kind of external incision, as long as it is not too small, whether it be transverse, oblique, vertical, or curved: the point in view is to have one large external incision and many small internal ones. The two first sections of the prostate are to be made along the two inferior oblique diameters of the gland, which will be sufficient when the stone is of moderate size; but when large, the two superior oblique divisions are to be made, first one and then the other." (See woodcut, AEEE.)

We shall now pass on to *lithotomy through the rectum*,—the *recto-vesical operation*. This has been recommended in consequence of its supposed readiness of performance, and the easy passage of instruments, besides being free from hæmorrhage. The operation consists in placing the patient in the same position as for ordinary lithotomy; a grooved curved staff is then introduced into the bladder, and held by an assistant firmly and perpendicularly, so that the groove is in the median line. The operator takes a sharp-pointed straight bistoury in the right hand, resting the blade flatways on the palm or surface of the left forefinger, which latter is then introduced into the rectum to the extent of 10 or 12 lines. With the right hand the edge of the knife is turned upwards, and its point thrust through the anterior wall of the rectum, so as to gain the groove of the staff, and as the knife is withdrawn, it cuts through the rectum, the external sphincter and cellular tissue covering the urethra and integument in the median line, to the extent of one inch. The left forefinger is next carried into the wound of the sphincter, and the nail inserted into the groove of the staff, when the bistoury, with its edge downwards, is guided along it through the wall of the urethra into the groove, and pushed in the direction corresponding to the raphé, dividing the neck of the bladder and the prostate to a greater or less extent according to the presumed size of the stone; the staff having been removed, the finger is introduced into the bladder, and the calculus extracted by the forceps.

The drawbacks to the operation are the gliding of the mucous membrane of the rectum before the knife, the great risk of wounding the peritoneum and vesiculæ seminales, the subsequent occurrence of urinary infiltration, the passage of fæces into the bladder, fistulous sinuses, &c. Of 185 cases operated on, 38 died, being 1 in 4·86; but the subsequent condition of those who recovered is not stated.

The hypogastric or high operation. Epicystotomia is considered by some Surgeons the most direct, short, and least dangerous operation. Its advocates argue that there are no technical or anatomical difficulties, with the exception of the peritoneum, which is easily avoided. It suits all sizes of stone, enables the Surgeon to have a free opening into the bladder, and there is not so much danger of infiltration of urine as has been alleged. The wounding of the peritoneum must be regarded as a failure in anatomical manipulation. Pitha remarks, that in male children and young persons below 20, as well as in females, the bladder stands high above the pubes, and presents an uncovered portion freely to surgical manipulation; under 8 years the peritoneal reflection from the bladder does not generally reach lower than $1\frac{1}{2}$ to 2 inches from the navel. In old persons, especially when emaciated, the bladder lies deep in the pelvis, behind the symphysis, and is difficult to reach; hence the impropriety of operating by this method in such cases.

Other Surgeons maintain that there is great risk of peritonitis, infiltration of urine, and wound of the peritoneum, and that the operation is only applicable in cases of deformed pelvis ; and where there is much fat it is rendered very difficult.

The old method was that of Franco, who introduced a finger into the rectum and pushed the stone up towards the hypogastrium, and its prominence formed the guide for the incision. A more cautious proceeding was afterwards adopted. The preparation for the operation consists in emptying the rectum and distending the bladder, either by the patient retaining his urine or by injecting a sufficient quantity of tepid water to produce distension without over-excess, which latter is best performed under chloroform at the time.

The patient is placed on the back, with the pelvis raised, and the operation is performed in three steps. The first consists in laying bare the anterior wall of the bladder, by a vertical incision in the median line immediately above the pubes, cutting through the linea alba and fascia transversalis, and exposing the loose subfascial cellular tissue, in which some fat is often found.

The second step is that of opening the bladder, and is the most important part of the operation, requiring the greatest precision and care ; the opening ought to be made close to the symphysis, and quite in the median line. Some Surgeons have suggested and used an instrument called the sonde-à-darde, which consists of a trocar concealed in a catheter. This is introduced through the urethra into the bladder, and then the trocar is extruded and pushed through the fundus of the bladder at the external opening. This is considered both imprudent and mischievous. It is best to transfix the bladder through the wound, and thus secure it. The bladder is then to be opened by a median incision from below upwards. A few authors recommend a transverse incision. The external incision in the mean while must be kept open by retractors, in consequence of the tendency of the parietes to contraction.

The third step consists in the extraction of the stone, which may be readily done by a pair of straight forceps.

Civiale uses the sonde-à-darde, and has otherwise modified the operation.*

The after-treatment is now confined to simple measures ; formerly a gum catheter was left in the bladder, others made a counter-opening in the perineum to drain off the water, and some used sutures in the bladder ; but it is now considered more judicious to place the patient in bed on the back or sides with the legs drawn up, to employ water-dressing, and nothing else. No catheter, no canula, no other measure, is required.

Vidal recommends the operation to be performed "en deux temps." An incision is to be made in the median line, dividing all the tissues and exposing the bladder ; then the operation is to be set aside, and the wound filled with charpie, which is to be replaced daily, so as to prevent union. If at the end of 6, 7, or 8 days there be abundant suppuration, the operation is to be completed by opening the bladder with a straight bistoury, and extracting the calculus.

In taking a general survey or making any critical comparison of the various principal operations and modes of removing a calculus from the bladder, much will depend upon the age and condition of the patient, as well as the size and nature of the stone. In the first place, the great point will be to determine whether the case be fit for the operation of lithotrity. This subject, however, is alluded to in a separate section. When lithotomy is determined upon, there can be no doubt for a moment that in children under 12 years of age the lateral operation is the safest and most successful, the mortality being 1 in 17½ cases only. Of course this does not preclude the performance of the median operation, where the stone is small or even of moderate size. At puberty and adolescence, and in manhood and adults, from 12 to 48

* See Thompson, op. cit. p. 72.

years, the mortality of the lateral operation rises to nearly 1 in 8, and from 49 to 81 years it amounts to 1 in 4 cases. It is in these periods of life, then, that some other modes of operating have been suggested to lessen the mortality. Statistics have not yet shown so much improvement as might be anticipated. Thus in Allarton's median operation on 139 cases at all ages, 13 deaths ensued, being 1 in 11; and when restricting this to adults, the mortality was 1 in 7; and in Mr. Williams's report the mortality over 50 years of age is nearly 1 in $2\frac{1}{2}$. Of 60 cases operated upon by Buchanan's method, the result seems to be the same as in Allarton's operation, except that in adults the mortality is 1 in 8.

The bilateral operation of Dupuytren bears a death-ratio of 1 in $4\frac{1}{2}$, the recto-vesical about 1 in 5, and the supra-pubic 1 in $3\frac{1}{2}$. These latter proceedings are only had recourse to in cases of very large stone and where complications exist preventing perineal lithotomy.

As far as our present information extends, the median operation may be performed with safety in cases where the stone is small; but the lateral operation is to be preferred in all other cases where lithotrity is inexpedient.

The main issue, as regards the success of any one form of operation, seems, after all, to be chiefly dependent upon the mode of enlarging the opening of the urethra through the prostate and the neck of the bladder. This resolves itself into one of two proceedings; either dilatation of the prostate and neck of the bladder, as in the median operation, or section of these structures, as in lateral lithotomy. Is it safer to dilate, bruise, and lacerate the prostate gland and neck of the bladder, or to make a clean, careful incision with the knife? Small stones are no test whatever as to the value of either mode of operation, nor are calculi in children; for in the latter, whichever mode is adopted, a recovery is expected.* It is in adults that we are always trying to lessen the mortality after the lateral operation, and none of the recent improvements seem to have supplied the deficiency. Even in Mr. Allarton's recent table, p. 499, 2d edit., his mortality is 1 in 7.

We should have gladly quoted the table inserted in that work, which consists of 170 cases of median lithotomy, but these do not in the least represent the actual state of affairs: the cases are for the most part taken from all sorts of reports of a successful issue; many known cases of death after the median operation are unrecorded; in two instances the author himself has been obliged, in consequence of the size of the stone, to abandon the operation, and terminate it by section of the prostate gland; which latter proceeding undoubtedly led to the successful termination. Median lithotomy, therefore, necessitates the bruising and laceration of the prostate gland, in cases of stone above a certain size, and in consequence will almost inevitably lead to a fatal result. The lateral section still maintains its position as the safest; it was so with Cheselden, Crosse, and numerous other Surgeons.

The most perfect and unique collection of cases of the median operation, performed at a hospital of well-established reputation for lateral lithotomy, will give more insight into the comparative merits of the two operations; and we gladly avail ourselves of the opportunity of presenting to our readers one that has been so formed. By permission of Mr. Williams we are enabled to insert his tables, and thus compare the results of 44 cases of median lithotomy with the last 44 current cases of lateral lithotomy performed at the Norfolk and Norwich Hospital up to November 1863.

* Thus, in the last two years, at Guy's Hospital, fifteen children under 14 years of age underwent lateral lithotomy, without any unfavourable result; and it is not improbable that median lithotomy might have been similarly successful.

Table of cases where median lithotomy was performed at the Norfolk and Norwich Hospital; showing the age in years, the result, the number of days under care after the operation, the number of calculi removed from each patient, the dimensions and weight of each calculus.

No.	Age.	Result.	Days under care.	No. of calculi.	Dimensions in inches.			Weight, and Remarks.
					Length.	Breadth	Depth.	
1	2	cured	22	1	$\frac{6}{8}$	$\frac{4}{8}$	$\frac{2}{8}$	14 grains.
2	2 $\frac{1}{2}$	"	35	1	$\frac{6}{8}$	$\frac{5}{8}$	$\frac{1}{8}$	34 grains.
3	3	"	23	1				14 grains.
4	3 $\frac{3}{4}$	"	29	1	1 $\frac{1}{8}$	$\frac{7}{8}$	$\frac{5}{8}$	3ij.
5	4	"	29	1				35 grs.; calculus broken in the extraction.
6	4	"	15	1				16 grs.; calculus broken in the extraction.
7	4	"	29	3				Small calculi; all weighing 30 grs.
8	4	"	36	1	1	$\frac{6}{8}$	$\frac{3}{8}$	47 grains.
9	5	"	50	1				15 grains.
10	5	"	22	1	$\frac{6}{8}$	$\frac{4}{8}$	$\frac{4}{8}$	3ij.
11	5 $\frac{1}{2}$	"	29	1				8 grains.
12	6	"	22	1				3jss; broken in the extraction.
13	8	"	35	1	1	$\frac{6}{8}$	$\frac{4}{8}$	3v.
14	10 $\frac{1}{2}$	"	16	1				3 grains.
15	11	"	21	3				3ij 3ij; all of them broken during the extraction.
16	12	"	28	1				6 grains.
17	13	"	29	1				3j; broken during the extraction.
18	19	"	56	1	1 $\frac{1}{8}$	1 $\frac{1}{8}$	$\frac{7}{8}$	3ij 10 grs.; a perineal fistula was established.
19	33	"	22	1	1 $\frac{3}{8}$	1 $\frac{1}{8}$	$\frac{3}{8}$	3ij 10 grains.
20	33	"	15	2	$\frac{1}{2}$	$\frac{1}{8}$	$\frac{1}{8}$	One calculus weighed 3vij, the other not quite 3vj; one calculus was pear-shaped and encysted.
21	57	"	29	5	1	1	$\frac{4}{8}$	Each weighed about 3ij, in all 3xij 3ij; each calculus was of the same dimensions.
22	57	"	29	1	1 $\frac{2}{8}$	1 $\frac{1}{8}$	1	3ij.
23	59	"	16	1	1 $\frac{1}{8}$	1	$\frac{3}{8}$	3j 13 grains.
24	60	"	15	4	1 $\frac{2}{8}$	1	$\frac{5}{8}$	Each weighed about 3ij, all weighed 3vij; the largest of the four had the dimensions given.
25	61	"	37	1				3v; broken in the extraction.
26	61	"	31	10				All weighed 3ij.
27	63	"	69	1	2 $\frac{6}{8}$	2	1 $\frac{4}{8}$	3iv 3v; a recto-vesical fistula remained.
28	66	"	42	1				22 grains; broken in the extraction.
29	66	"	36	5				All of them weighed 3vij. This was the 2d operation; a fistula remained after the 1st, which was cured by the 2d. The same case as No. 28.
30	67	"	30	1	1 $\frac{3}{8}$	1 $\frac{1}{8}$	$\frac{5}{8}$	3ij 3ij.
31	68	"	29	2	1 $\frac{1}{8}$	$\frac{1}{2}$	$\frac{1}{2}$	Both weighed 3ij, and both were of the same dimensions.
32	70	"	22	1				3ij; phosphatic, and broken in the extraction; a perineal fistula present from a former operation (lateral).
33	72	"	50	1				3j; broken in the extraction. The same patient as No. 32. The fistula was not healed by either 1st or 2d operations.
34	1 $\frac{1}{2}$	died	1	2				Both weighing 3ss.
35	37	"	13	1	1 $\frac{5}{8}$	1 $\frac{4}{8}$	$\frac{7}{8}$	3vij.
36	55	"	3	2				Both weighed 3vij, and were broken in the extraction.
37	57	"	11	1	1 $\frac{6}{8}$	1 $\frac{4}{8}$	1	3j 3ij.
38	61	"	9	2	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{8}$	One calculus weighed 3v, the other 3v 3ij
39	62	"	18	1	1 $\frac{1}{8}$	1	1	3vj.
40	64	"	86	3	1 $\frac{4}{8}$			All broken in the extraction; together weighing 3x.
41	66	"	4	1	1 $\frac{6}{8}$	1 $\frac{1}{2}$	$\frac{6}{8}$	3vss.
42	66	"	2	1	2	1 $\frac{1}{2}$	$\frac{1}{8}$	3j.
43	66	"	4	1	2	1 $\frac{4}{8}$	1	3xij.
44	68	"	14	1				6 grains.

N.B. The weight of every calculus was taken on the day of its removal.

<i>Ages of the patients.</i>		<i>Deaths after median lithotomy.</i>	
Under 5 years of age . . .	9 cases.	Under 5 years of age . . .	1 case.
From 5 to 10 . . .	5 "	From 30 to 40 . . .	1 "
" 10 " 20 . . .	5 "	" 50 " 60 . . .	2 "
" 20 " 30 . . .	0 "	" 60 " 70 . . .	7 "
" 30 " 40 . . .	3 "		—
" 40 " 50 . . .	0 "		11
" 50 " 60 . . .	5 "		
" 60 " 70 . . .	15 "		
" 70 " 80 . . .	2 "		
	—		
	44		

Table of the last 44 cases of lateral lithotomy performed at the Norwich Hospital.

<i>Ages of the patients.</i>		<i>Deaths of these patients.</i>	
Under 5 years . . .	5 cases.	From 50 to 60 . . .	1 case.
From 5 to 10 . . .	4 "	" 70 " 80 . . .	1 "
" 10 " 20 . . .	4 "		—
" 20 " 30 . . .	3 "		2
" 30 " 40 . . .	3 "		
" 40 " 50 . . .	1 "		
" 50 " 60 . . .	8 "		
" 60 " 70 . . .	10 "		
" 70 " 80 . . .	6 "		
	—		
	44		

Average number of days that each of the 33 cases of cure, after median lithotomy, was under care was thirty days.

Average number of days that each of the last 33 cases of cure, after lateral lithotomy, was under care was thirty-seven days.

Table of the number and weight of the calculi removed from those who died after median lithotomy.

Under 5 years . . .	1 calculus, weighing	5ss.
From 30 to 40 years . . .	1 "	5vij.
From 50 to 60 years . . .	{ 2 calculi, both weighing	5ij 9j.
	{ 1 calculus, weighing	5j 9ij.
From 60 to 70 years . . .	{ 1 "	grs. vj.
	{ 1 "	3vss.
	{ 1 "	5j
	{ 1 "	5xij.
	{ 1 "	5vj
	{ 2 "	5j 5ij.
	{ 3 "	5x 9ij.

Number and weight of the calculi removed from those who died after lateral lithotomy.

From 50 to 60 years, 1 case . . .	1 calculus, weighing	5ij
" 70 " 80 " 1 " . . .	1 " "	5ij.

Remarks by Mr. Williams on the cases of median lithotomy.

Two cases were cut twice by the median plan, at intervals of nine and four months respectively.

In no case did recovery result when the calculus exceeded 3 drachms 2 scruples; except in one case, in which the stone weighed upwards of 4½ oz., but a portion of the rectum and perineum sloughed, and a perineo-recto-vesical fistula was established.

In no case did a cure result when the long diameter of the calculus exceeded 1½ inches, and the short 1½ inch, except in the case in which the stone weighed upwards of 4½ oz.

Calculi in the prostate gland.

The prostate gland, like other glands, is liable to an inspissation of its secretion, producing small yellow, sometimes red, pale or colourless bodies scattered throughout the follicular structure. These at first are said to consist entirely of organic matter, which Virchow believes to be derived from a peculiar insoluble protein substance mixed with the semen; but sooner or later these formations are believed to irritate the mucous membrane, causing phosphatic depositions, which become encrusted upon the organic matter, and thus the genuine prostatic calculi are formed.

Prostatic calculi, therefore, have their development and origin in the gland-tissue. Their number varies from 1, 2, 3, to 100 or more, like a bag of marbles. Their size may be that of a few grains like sand, or may increase to that of a poppy-seed or cherry-stone. As they gradually enlarge, they come in contact with each other, and undergo a degree of attrition, whereby they form facets or articulations, and the surfaces are often rendered as smooth as porcelain.

Their form, then, generally is very irregular, sometimes triangular, square, &c.

Their colour is generally that of brown chestnut, sometimes whitish, black, or red; the brown coating is supposed to be derived from the secretion of the gland; sometimes they are transparent, pearly, like pearl-barley.

Their structure and consistence also varies; they are sometimes of not very great consistence, and amorphous; but generally in concentric layers around a central nucleus; occasionally with radiating striæ; and sometimes they are compact, firm, and brittle.

Their chemical composition, according to Dr. Wollaston, is:

Phosphate of lime	.	.	.	.	84.5
Carbonate of lime	.	.	.	.	0.5
Animal matter	.	.	.	.	15.0
					100.0

Although prostatic calculi in their early formation are seated in the gland-substance, becoming enveloped on all sides by its tissues, and forming for themselves a bed in the lateral lobes, and when enlarged encroaching upon the rectum, so as to be felt by digital examination; yet more frequently they distend the prostatic ducts, converting them into pouches, and appear at their open mouths, so as to be felt by the sound in its passage along the

prostatic portion of the urethra. These calculi may project into the urethra, and thus have a free urethral surface and an adherent prostatic portion. Either of these surfaces may become enlarged, the prostatic portion attaining the size of an ordinary urinary calculus, and its urethral portion may extend backwards into the bladder, forming a prostatovesical calculus.*

Sometimes one or more prostatic calculi may be detached from its recess and lie free in an open duct.

The other forms of calculi in the prostate are derived from a very different source; thus, a urinary calculus may escape from the bladder when small, and become lodged in the prostate: this may either obstruct the canal, or may be expelled along the urethra; or it may form a bed for itself in the prostate gland either by ulceration or pressure. These calculi are readily recognised on section as presenting all the characters of the ordinary urinary calculus, and as being totally different from the true prostatic calculus. But they so far resemble each other, that where a urinary calculus becomes lodged in the prostate, the successive deposits hereafter ensuing consist of phosphate and carbonate of lime; so that in external appearance they are somewhat like that of the true prostatic calculus. After lithotripsy, and even after lithotomy, fragments of stone may become arrested or left in the prostate; so that after one, two, three, or more years, a prostatic calculus may be developed, the nucleus being a fragment of a urinary calculus.

There is one other rare variety (the vesico-prostatic); it is that in which a vesical calculus is situated within the bladder, near its neck, which on increasing in size sends a prolongation through the vesical opening of the urethra into the prostate gland. Here again it enlarges, both vesical and prostatic portions increase, and their bar of union remaining stationary produces the same condition as is observed in the prostatovesical variety, viz. a dumb-bell or bar-shot-shaped appearance. It is singular that in the majority of instances the urethra above was perfectly pervious, allowing a free flow of urine and the passage of a sound over the stone.†

The symptoms depend, of course, upon the size, number, and situation of the calculi, and vary exceedingly; being sometimes very slight. Indeed in some instances there have been no symptoms whatever, and the presence of the calculi was only ascertained after death: when the calculi are large, and encroach upon the

* See collection of cases in the *Guy's Hospital Reports*, series iii. vol. iii. p. 351.

† Ibid.

urethra, there is a sense of pain and weight in the perineum, and frequent micturition, irritation and uneasiness at the neck of the bladder; the prostate may become inflamed, and abscesses follow. Sometimes there are continual semi-erections of the penis, and difficulty in the emission of semen.

The diagnosis is arrived at by exploration of the urethra by means of a sound or lithotrite, and the introduction of the finger into the rectum. Soft bougies of a large size have been recommended, which are to receive the impressions of the stone; but these impressions may become obliterated on withdrawal of the bougie.

The treatment will consist in removing them by means of a properly constructed forceps,* when the calculi are small and free; but, generally speaking, an external incision is requisite. The operation is conducted in the same way as for lithotomy, with these exceptions: the incision is to be made in the median line, and should include a sufficient section of the prostate for the escape of the calculus. If there are no symptoms, some recommend that the case should be left alone; others advise that when the symptoms are urgent the calculus should be pushed back into the bladder: this latter suggestion only applies to lodged urinary calculi or fragments of calculi, where the urethral forceps have failed. Where the stone has attained a large size, lateral lithotomy must be performed.

Calculi in the urethra are for the most part derived from the bladder and kidney, or from fragments of calculi becoming arrested at the narrower parts of the canal, more especially the membranous portion, there lodging and setting up various symptoms. However, in some very rare instances the calculus may be formed in the urethra, in this wise: urine collects behind a stricture or constriction, and a pouch or diverticulum thus ensues, wherein urinary deposit may take place and form the nucleus of a calculus, generally of the lithic-acid variety; but it is more probable that a particle of calculous matter or small particles of gravel have become arrested in this pouch and given rise to stone.

The size of the stone varies; where there is only one, it is generally of a larger calibre than the urethra in its transverse diameter, and assumes an elongated form; they may acquire a very large size; where there are several, they are often small and faceted, generally plane and smooth.

The symptoms are very variable—in some cases there are none at all; in others there is acute pain at the site of the calculus, and if this be rough, the pain is very excruciating. The urine may escape

* Such as Weiss's long urethral forceps, $8\frac{1}{2}$ inches long; the ends of the blades are not pointed, should not meet each other, and should be slightly scooped; or Weiss's canula forceps.

freely, or it may be passed frequently, or there may be a frequent desire with inability to micturate, or there may be actual retention; this latter symptom is more frequently present where the stone is lodged in the fossa navicularis. When left alone, dilatation of the urethra ensues, excavations and pouches are induced, ulceration of the urethra follows, and sometimes rupture, causing infiltration and extravasation of urine, involving the scrotum; this is attended with high irritation, fever, and constitutional disturbance. Suppuration may follow, and the abscess burst externally, allowing the exit of the stone, which is succeeded by urinary fistula. Ischuria and enuresis may likewise be produced; and in some rare instances suppression of urine and uræmia may follow.

The diagnosis is generally easy by careful exploration of the canal with a small-sized sound or a long probe, the finger at the same time being passed along the outside of the canal, so that when the instrument impinges upon the stone, the finger may be placed on its vesical side, so as to prevent the pushing back of the stone and its slipping into the bladder. Rectal examination is oftentimes of service.

The treatment by endeavouring to facilitate the escape forwards by means of suction and insufflation, as practised in former years, is obsolete, and inefficient for its purpose. There is always a gradual tendency of the urine to push the calculus forwards; hence the Surgeon often directs compression of the urethra to be made in front at the moment of micturition: when the urine has been retained in the bladder and urethra as long as possible, the compression is to be suddenly withdrawn, and the calculus may often follow in the gush. This failing, a warm bath should be ordered, and the urethra dilated with a bougie, which may prove successful. The case, however, generally resolves itself into the attempt at the removal of the calculus by instruments passed into the urethra; and here numerous instruments have been devised both in this and in other countries, and with some satisfactory results. In some instances these have succeeded in their object; in others a failure has been experienced. We must bear in mind that too much endeavour at extraction by means of forceps is bad, and detrimental to the canal and the patient. The quickest, easiest, and safest remedy, after failure of the forceps, is the incision in the median line over the seat of the stone. Make a good long clean cut at once down upon the stone, and turn it out, taking care it does not slip back by planting the finger or thumb of the left hand firmly upon the urethra behind the stone. There is no risk from a clean incision either of extravasation or fistula; for the incision generally heals quickly without trouble, and without any subsequent stricture or fistula. When the stone is opposite the scrotum, provided it cannot be extracted per urethram, it is best to push it back into the perineum, and thence to extract it by incision. Incisions into the urethra in front of the scrotum are very often difficult to heal, and leave a fistulous opening. Should the calculus slip back into the bladder during the median operation, a long pair of slender forceps may be introduced, and the stone removed.

Calculus in the female, although not very frequent, is by no means so rare as is usually supposed. The peculiar anatomical

arrangements of the urethral canal from the bladder to the exterior render any obstruction to the passage of a small calculus comparatively unfrequent; there is no prostate gland, and there are no natural contractions of the canal; the urethra is short and readily dilatable; there is scarcely any curve. So that although females may be prone to calculous depositions, as well as males, yet they escape the dire consequences of its retention in the bladder by the above arrangement of the parts. We cannot judge of the frequency of the disease in females as compared with males by the proportion of cases operated upon; for in the one instance a large proportion of the calculi escape, or are removed by dilatation without operation, while on the other hand, nearly all the males undergo lithotomy or lithotripsy; and hence we have no data to rest upon.

The symptoms, when a stone has become so large as not to escape from the bladder, will consist of many of those already detailed in the male; but the special symptoms in the female consist in,—1st, bearing-down pains and pains along the urethra; 2d, incontinence of urine. These are sometimes very distressing, and call for urgent attention.

The symptoms often simulate those of uterine disease, for which they are not unfrequently mistaken; so that the Surgeon should be on his guard, and on failure of detecting uterine mischief, he is bound to pay special attention to the bladder and rectum.

The natural progress of calculus in the bladder, where no remedial measures have been resorted to, will be the ulceration of the stone through the bladder into the vagina, by which a cure is effected, but at the expense of a vesico-vaginal fistula; a circumstance which is always to be avoided if possible.

The methods for extracting calculi from the female bladder are the following:

1st. Dilatation of the urethra: a slow, gradual, and gentle process by means of solid or flexible bougies, gum-elastic catheters, prepared sponges, &c.; or by care and judgment in the use of Weiss's dilators, the speculum or blunt gorget. The dilatation must not be carried to excess, otherwise incontinence of urine will be the result. After full dilatation, a pair of forceps are to be introduced, and the stone extracted.

2d. Dilatation with partial division of the urethra where dilatation has been carried on to its proper limits, and yet the stone is too large for extraction, and division by the knife is necessary.

3d. Lithotripsy—alluded to in the ensuing section. The operation under chloroform is readily performed, and the fragments removed at once: the author has had several very successful cases of the kind; the lithotrite of course requiring to be adapted to the age of the individual.

4th. Lithotomy. The patient under chloroform is placed in the same position as for males, and a grooved staff is introduced into the urethra. A bistoury and proper forceps are all that are required. The following are the

several modes of performing the operation: 1st. Urethral lithotomy, the most common and ordinary method, has been executed in every possible direction, generally implicating the neck of the bladder. The incision into the urethra most frequently practised has been analogous to the lateral operation for lithotomy in males, viz. by introducing the knife into the groove of the staff and cutting downwards and outwards at an angle of forty-five degrees. This is called the oblique lateral or unilateral operation; the objection to it is the unavoidable subsequent incontinence of urine. Others have recommended a bilateral section of the urethra, but this has been attended by the same result. Liston modified this operation, for he only notched the neck of the bladder on both sides towards the ramus of each os pubis, and then dilated. A transverse incision has been performed, but without any additional success, and, again, the urethra has been divided vertically, by some in the direction upward towards the pubes, but the space was found too small, even with subsequent dilatation; and by others downwards, as suggested by Schellius.

2d. Attempts have been made to extract the calculus by opening the bladder directly, as suggested by Celsus. This operation consists in making a transverse incision between the symphysis and urethra, and thus attacking the anterior parietes of the bladder; and M. Lisfranc modified this into a curved incision, under the name of the vestibular operation: these operations have found no recent advocates.

3d. The calculus has been removed by incision through the vagina; a very easy and expeditious operation, but which is followed almost necessarily by vesico-vaginal fistula and incontinence. Some make the incision longitudinally, and others in a transverse direction. M. Vidal's experience is derived from thirty operations without any death: he introduces a staff which is held in the median line and its convexity made prominent in the vagina; a blunt gorgnet is introduced into the vagina deeply, so as to depress the inferior wall of the vagina (a speculum with one valve will do), and then with the left index-finger the groove in the staff is felt, and the bistoury plunged into it, taking care to avoid wounding the urethra; the stone is extracted by the forceps; a female catheter is introduced through the urethra into the bladder; and the edges of the wound in the vagina brought together by suture. M. Vidal remarks that there is generally no hæmorrhage or peritonitis; but that fistula often follows.

4th. It has been recommended to remove the calculus by the supra-pubic operation, and the same remarks as were made respecting the male will hold good for females.

Statistics respecting stone in the female, the operation and its consequences, and the mortality after operation, are incomplete and unsatisfactory.

ALFRED POLAND.

LITHOTRITY.

THE amount of mortality attending the operation of lithotomy in the adult has always made it a question of paramount importance with Surgeons to discover some more successful method of removing a calculus from the bladder.

It is not necessary here to allude to the attempts made from time to time to get rid of the calculi by injecting solvents into the bladder.

The removal of calculi from the bladder through the urethra was effected by Sir Astley Cooper and Sir Benjamin Brodie before the introduction of lithotritry into practice. These Surgeons were in the habit of removing small calculi with an instrument called a urethra forceps. Sir William Blizard is also said to have performed this operation. And in this way patients were successfully relieved of small calculi; in one case as many as a hundred being thus removed.

To give a detailed account of the early history of lithotritry would now be of little interest. Whether the credit of originating the operation is due to the Spanish monk or to the Indian officer—who both performed an operation on themselves for the purpose of breaking a stone in the bladder—is not now of much importance. It is admitted that to M. Civiale we are indebted for the operation as practised at present.

Among those who have written on the subject, and whose works may be consulted for a history of the operation in all its earlier stages, are Gruithuisen, Elderton, Civiale, Amussat, Leroy d'Etiolles, Heurteloup, King, Costello, Belinaye, Coulson, and others.

Baron Heurteloup was among the earliest who performed the operation in this country. At first, several instruments were used by him, such as the *perce-pierre*, *trois branches virgule*, *évideur* or forceps, &c.; the intention being to seize the stone, and break it up by drilling holes in it: he eventually made use of an instrument invented by Mr. Weiss, called the sliding forceps, to which he applied a hammer, the stone being broken by percussion. All these instruments and modes of operating have been for many reasons superseded by the plan now in general use, viz. crushing the stone by means of the lithotrite.

Sir Benjamin Brodie, who paid great attention to lithotritry on its first introduction, and to whom is due much of the simplicity of the present mode of operating, says, in his *Lectures on Diseases of the Urinary Organs*: “Many years ago Mr. Weiss made an instrument on the principle of what I have called the sliding forceps, having a screw* attached to it for the purpose of dividing calculi while still in the bladder into fragments; but it was of rude construction, and, such as it then was, was certainly not fitted for use on the living subject.” “Baron Heurteloup at first pursued M. Civiale’s method of operating; but finding it liable to some very serious objections, he adopted the principle of the sliding forceps invented by Mr. Weiss, at the same time modifying its shape so as to render it more convenient for being passed into the bladder, and for seizing and retaining the stone afterwards. Besides this, he made another change in the

* The application of the screw was first suggested by Mr. Hodgson, formerly Surgeon to the Birmingham Hospital, who early practised lithotritry. He had been a successful operator, having performed lithotomy eighty-six times, with only four unsuccessful cases: he was the Surgeon referred to by Sir Benjamin Brodie in his work on *Diseases of the Urinary Organs*, as having recommended, in lithotomy in the female, division of the urethra immediately below the symphysis of the pubes.

instrument, rejecting the screw, and substituting for it a peculiar apparatus which enabled him to crush the calculus by a stroke of the hammer. Now the first of these alterations, made by Baron Heurteloup, I believe to have been of essential importance; in fact, without it, the instrument would have remained wholly inapplicable to any useful purpose. But as to the second alteration, I cannot say that any thing that I have seen, either in my own practice or in that of others, would lead me to regard it as being any improvement whatever." Sir Benjamin Brodie in his early operations was accustomed to use an instrument—a scoop lithotrite—so constructed that a portion of the crushed calculus always remained within the blades; by this means a considerable quantity was removed at each operation by the repeated introduction of the instrument. But this method was attended with great objections; the withdrawing the instrument loaded with fragments stretched the urethra beyond its natural size, giving much pain at the time, as well as afterwards. When the urine was passed, it was occasionally attended with some bleeding, and in some instances the urethra was torn, fragments lodging in the torn portion; infiltration of urine, followed by perineal abscess, were the consequences, and in two such cases death resulted. In referring to these cases, Sir Benjamin Brodie, in his *Notes on Lithotomy* in the 38th volume of the *Medico-Chirurgical Transactions*, says: "The experience of these cases led me some years since to discontinue the use of the forceps already referred to, or at least to have recourse to it very rarely, and only under some special circumstances, and to substitute for it a forceps made by Mr. Weiss, in which there is a longitudinal opening in the curved part of the fixed blade, with a corresponding projection in the opposite or sliding blade. The effect of this instrument is to crush a calculus very completely, and in such a way that no part of it remains between the blades, the whole being left to be passed with the urine afterwards. The ultimate cure of the patient may in some instances be thus a little (but not greatly) protracted; but this inconvenience is more than compensated by the smaller amount of pain which the patient suffers, the smaller liability to rigors, and the complete absence of danger from the infiltration of urine and perineal abscess." This instrument, now called the "screw lithotrite," is the one in very general use. Alterations have been made in it. The rack and pinion, applied instead of the screw, was originated by Mr. Fergusson, and is used by that Surgeon. Mr. Coxeter, and more recently Mr. Weiss, have also made alterations, by which it is intended to allow of more rapidity in operating, and to gain lightness in the make of the instrument; but I must confess that, notwithstanding the high authorities in favour of these alterations, I cannot consider them in the light of improvements. The instrument just described has, I think, still advantages over any other; it is simple in construction, quite as light as it is safe to have it made, and it is not so liable to get out of order as those of a more complicated construction.

It may be as well first to describe the methods of performing the operation, and then to consider the cases to which it may be applied.

When the symptoms are such as to lead one to suspect that a patient has a calculus in the bladder, should there be any considerable amount of irritation of that viscus, and instruments have not previously been used, it is well to keep the patient confined to the sofa for a day or two before any examination is made; and should the general health need it, to give such medicines as may be necessary.

In examining the bladder, instead of using a sound, the better mode is, having placed the patient on a sofa, with the pelvis raised by means of a pillow, to inject into the bladder through a silver catheter about four or five ounces of water; to the catheter should be attached a stop-cock, so that the water may be retained in the bladder during the examination. If the stone be of any size, it is usually detected by means of the catheter; but should this not be the case, the lithotrite may be introduced, and an examination made in the same manner as will be described when it is used for crushing the calculus.

Having ascertained the presence of a stone, and decided that lithotomy is the operation to be performed, it is necessary to place the patient in as favour-

able a state as possible for what he has to undergo. One of the first requisites is, that the bladder should be able to contain a sufficient quantity of water to render the necessary use of instruments safe; and it is not unfrequently required, on account of the intolerance of the bladder to a sufficient quantity, to inject the bladder, and keep the water in for a short time on one or two occasions previous to the introduction of the lithotrite. After such treatment the bladder usually retains the necessary quantity. If an extreme irritability should continue, so that at least four ounces of water is not borne, the administration of an injection (containing twenty or thirty drops of laudanum) per rectum most frequently accomplishes the desired object. It is also necessary in some cases where instruments have not been previously used, or where there is any difficulty in introducing them, to pass an instrument a few times on different occasions before proceeding to crush the stone.

The bladder and urethra being thus prepared, the following is the mode of proceeding to be adopted. The patient should the day before take a dose of aperient medicine, and be confined to the house for a couple of days, so that the urinary organs should be in as quiet a state as possible. The patient being placed on a sofa, with the pelvis raised as before described, from four to six ounces of warm water should be injected into the bladder; it is as well to have the piston of the syringe graduated, so as to know exactly the quantity of water injected. Should there be much spasm, so that the bladder resists the introduction of the water, this part of the operation must be conducted slowly, only a small quantity being introduced at first; indeed, if it is found that the bladder will not retain the requisite quantity, the further performance of the operation must be postponed to a future occasion. In some cases, where this intolerance continues, the following plan may be adopted: desiring the patient to retain the urine for as long a time as possible previous to the operation being attempted, and the Surgeon being satisfied that a certain quantity of urine is in the bladder, he may introduce the lithotrite, and crush the stone *once*; when a stone has been once crushed, this irritation of the bladder not unfrequently ceases. It is the practice of some Surgeons not to inject any water into the bladder before the introduction of the lithotrite. I have found that the bladder more readily retains the water injected, than the urine that may be in the bladder when the lithotrite is introduced.

The principal requirement in the operation of lithotrity is, that the calculus should be broken into pieces of such size as may be readily passed; and it is to be considered what is the best method of accomplishing this with as little disturbance to the bladder as possible. The size of the instrument must depend in some measure on the supposed size of the stone, which there is no method of ascertaining with any very great accuracy; if the stone is not large, a medium size is all that will be required; but should there be any doubt as to the size of the stone, a large instrument should always be used on the first occasion of operating.

The introduction of a lithotrite, from its shape, is more difficult than a catheter; and the passage of a lithotrite through the neck of the bladder requires caution and dexterity, and some amount of pressure is occasionally necessary. Where there exists much enlargement of the prostate gland, considerable difficulty is occasionally met with; but with proper manipulation this is overcome. It is of the greatest moment, in this step of the operation, that no attempt should be made to open the blades of the instrument until it is completely in the bladder; much mischief is sure to ensue if such an attempt is made. The next step is the manipulation necessary for the seizing of the stone; on this great authorities differ. Sir Benjamin Brodie, in his *Notes on Lithotrity*, says: "The rule should be to *move the forceps in the bladder as little as possible*, never using it as a sound for the purpose of exploring the bladder, or ascertaining the position of the calculus. Such an examination does not assist the Surgeon in seizing the calculus afterwards; it gives pain to the patient, excites the bladder to contract and expel the water which had been previously injected; and I know that instances have occurred, though not in my own practice, in which a rough handling of the forceps has caused great injury to the bladder,

ending in the death of the patient. The rule for seizing the calculus (which I must acknowledge to have first learned from witnessing the very dexterous operations of M. Heurteloup) is as simple as possible. The patient lying on his back, the handle of the forceps is elevated, which of course brings the convex part of the curved extremity of it in contact with the posterior surface of the bladder, where it is contiguous to the rectum. The forceps is then to be opened by withdrawing the sliding blade to a greater or less extent, according to the probable size of the calculus, the fixed blade being at the same time pressed gently downwards in the direction of the rectum. The object of this manipulation is, that the forceps, being below the level of the other parts of the bladder, the calculus may fall into it by its own weight; and it is generally successful. If it should not do so, the forceps, without being moved from its situation, may be gently struck with the hand on one side, or on its anterior part, and the slight concussion thus communicated to the bladder will probably be sufficient to dislodge the calculus, and bring it within the grasp of the instrument. If it should be otherwise, the forceps, being closed, may be very gently and cautiously turned to one side or the other, so that the curved extremity of it may make an angle of 25° or even 30° with the vertical line of the body, then opened, and pressed in the direction of the rectum in the manner already described.

When the prostate gland is much enlarged, there is sometimes a difficulty in seizing the calculus, arising either from it lying under that part of the gland which projects into the bladder, or from the impediment which it offers to the elevation of the handle of the instrument. For such cases, the operating-table invented by M. Heurteloup, which enables the patient's shoulders to be suddenly lowered, is very convenient; or the same purpose will be answered sufficiently well if the patient be placed on a light sofa, the end of which may be raised by an assistant. The calculus is then seized, not in that part of the bladder which adjoins the rectum, but in the fundus, this being rendered the lowest point by the elevation of the pelvis."

M. Civiale recommends another method, thus described by Mr. Henry Thompson in his late work *On Lithotomy and Lithotrixy*: "The other mode is that of Civiale. Its principle is the reverse of the preceding. By position of the patient, the centre of the bladder and space beneath it are selected as the area of operation; no depression is made; contact between the walls of the bladder and the instrument is, as much as possible, avoided. The instrument is applied to the stone in the situation which this naturally takes, and the operator carefully avoids moving it, or any movements of concussion whatever, however slight. It is only due to the distinguished operators first named to say that this, the modern, and it is believed the improved, method, is in part due to the mechanical improvements which have been made in the lithotrite of late years. The method was scarcely possible until the present instruments existed.

"We shall now consider it in detail. The blades having entered the cavity of the bladder, the instrument slides easily and smoothly down the trigone, which in the living and healthy organ is an inclined plane, although quite otherwise in the atonied and in the dead bladder.

"In many cases the stone is grazed by the instrument as it passes, and the slightest lateral movement of the blades right or left will determine on which side it lies. If so, the operator is careful not to disturb it, but he inclines the blades *slightly away from the side on which it lies*, carrying the instrument gently in towards the posterior wall of the bladder, while the male blade is slowly withdrawn. It is important always to bear in mind, that as long as the blades are near the neck of the bladder, the male blade cannot be withdrawn, since it would impinge on that sensitive part and cause pain or injury. Having done so, he now inclines the well-opened lithotrite towards the stone, slowly closes, and almost certainly seizes it.

"But suppose no stone was felt on entering, he is then directed simply to withdraw the male blade an inch or more in the middle line, to incline the blades to the right side about 45° , and then to close them, without altering the axis of the shaft, or otherwise disturbing the central position of the instrument. Thus in almost all positions the stone is seized sideways by the blades of the

lithotrite, and very rarely by their extremities. If no stone is felt, he turns them, opened, to the left in a similar manner, and then closes them. Observe, that the blades are always to be opened before they are turned, for this reason: if the turn is first made and the blades are subsequently opened, the chance is that the male blade as it is withdrawn will move the stone away; whereas if the blades are inclined while open, the stone, if there, is almost certainly seized. This is one of the many apparently minute but extremely important points of which systematic lithotrity is made up. To return: it is very rare that the stone will elude the search thus far; but if it does, depress the handle of the lithotrite half an inch or so, which raises the blades very slightly from the floor of the bladder, and turn them another 45° to the left, bringing, in fact, the blades horizontal to the left; close: if unsuccessful, turn them gently to horizontal on the right, and close. These five positions (vertical, right and left incline, right and left horizontal) explore the bladder fully, middle, right, and left, and will almost certainly find any stone of moderate size in a healthy bladder. The object is at the same time strictly to avoid communicating any jerk to the instrument or to the bladder. In all these movements, if properly executed, there has been barely contact of the lithotrite with the vesical walls; at all events, no pressure, nothing to provoke undue pain, or cause contractions of the bladder. If, however, there is an enlarged prostate, causing an eminence at the neck of the bladder, a depression behind it, or the stone is very small, or we are exploring for some fragment, at the close of the case, which is suspected to have eluded previous search, the blades may be reversed so as to point downwards to the floor, and the object sought may then often be secured with ease. If seeking for a small stone or for fragments, we shall employ a lithotrite with short blades, which can therefore be reversed with much greater ease than one with long blades.

"In order to do this properly in the normal bladder, the handle of the lithotrite is depressed another inch or so, between the patient's thighs, so that the line of the instrument, instead of being directed obliquely a little upwards, is level with, or even points a little below, the horizon; the blades, supposed to have been already brought to the horizontal as before described, are cautiously turned, about 45° say, to the right (right reversed incline), so as to point obliquely to the floor, which should be barely felt, or very lightly touched by them. No pressure should be made on this part of the bladder by any part of the instrument, and it is easily avoided by depressing sufficiently the handle of the lithotrite. Then close the blades; next, turn them back, that is upwards, over to the left (left reversed incline), and close. Lastly, they may be brought round, to the reversed vertical position, and the floor lightly swept: this requires the maximum depression of the handle, and is only necessary to pick up small fragments with a short-bladed instrument. But when the prostate is considerably enlarged, and a stone or fragments have to be sought behind it, the lithotrite is reversed without depressing the handle.

"All these movements are to be executed at or beyond the centre of the vesical cavity, the proper area for operating, without hurry, rapid movement, or any other which partakes of the nature of a jerk or concussion, and, if in a fairly healthy bladder, without causing more than a very slight degree of pain to the patient. The operator's eye is also to be so familiar with the scale marked on the sliding-rod, that he knows at a glance the exact interval which it indicates as existing between the blades in the bladder.

"It is essential to good practice, while manipulating the lithotrite, to maintain the axis of the instrument, as far as possible, always in the same direction. The blades only are to be moved; the shaft should occupy the same inclination, unless when this is intentionally altered. In screwing home the male blade, the operator is very apt to move the lithotrite also, at each turn of the screw, unless he is conscious of the care necessary to avoid this evil. All lateral movements, all vibration and concussion, necessarily tell on the neck of the bladder and prostatic urethra, where the instrument is most closely embraced, and its mobility is most limited. To that part of the lithotrite which occupies the anterior portion of the urethra much freedom of lateral movement is permitted.

and in the bladder the instrument is free, although in a less degree; but the axis, or fixed point, as regards lateral movement, is at the part indicated, which is also the most sensitive spot of the entire passage. Hence the aim of the operator should be to produce in this situation no motion of the lithotrite, except that on its own axis. Few of the details of the operation require more practice to master than this.

"There is one important rule with reference to the situation of the calculus in the bladder. The larger it is, the more certain it is to be found lying near the neck of the bladder, in the ordinary recumbent position, while a small one is usually detected at the back of the trigone. This position of the large one requires a different method, and it will be found almost invariably successful. The moment the lithotrite enters the bladder, it is not to be pushed onwards to the bottom of the cavity; first, let the blades be inclined away from the side on which the stone is felt, then push on the female portion of the instrument only, by itself, as far as it will go, maintaining the male blade at the neck of the bladder; it is now only necessary to incline towards the stone, and it will be seized almost certainly at once. But if the operator commences by pushing on the whole instrument, and then withdraws the male blade according to the ordinary custom, this blade is infallibly drawn against the large one, which it therefore fails to catch, and presses it back against the neck of the bladder, producing pain, irritation, and perhaps bleeding: this is a practical rule of importance. As already intimated, for a small stone, the instrument slides down to the posterior wall of the bladder, the male blade is withdrawn, and the stone caught in the usual manner.

"Such, then, in the main, is the method of Civiale for finding the stone; the French, or English method, is without doubt an efficient one, but I believe it to be more irritating to the bladder, and less certain for removing every minute fragment towards the end of the operation, while it fails to deal efficiently with a stone lying behind an enlarged prostate. Hence the crushing operation has been often said to be inapplicable when such disease exists, a conclusion wholly unwarranted by the practice and results of modern lithotrity. Having tried both methods myself, I have no hesitation in preferring the former."

Notwithstanding the opinion thus strongly expressed by one so competent to come to a right conclusion on this matter as Mr. Thompson, I am still inclined to prefer and to recommend the method practised with so much success by Benjamin Brodie, as the one less likely to cause irritation of the bladder; and I have not found it attended with the disadvantages described by Mr. Thompson. The calculus being seized, by either method, the question then arises—how often should the process of crushing be repeated? In the first operation, the Surgeon should often be satisfied with crushing the stone but once, especially if the bladder is irritable. One crushing frequently relieves the patient of much pain and irritation of the bladder, particularly in the case of large stones, and it is well to give the patient as little inconvenience as possible the first operation, so that he may look to a repetition without dread. On the occasion of first seizing the stone, I usually move the instrument gently to the other side, to ascertain if there be more than one stone. The lithotrite being carefully withdrawn—care being taken that the blades are quite closed—the patient should at once go to bed, taking a glass of warm wine-and-water or brandy-and-water, and be kept warm, in order to prevent his having a rigor; should for the next twelve hours make water in the recumbent posture, and be confined to the house until the next operation.

The period that should elapse between the operations must vary: if at the first operation the calculus has been crushed once only, unless it be a small one, in all probability no fragments will be passed; in which case the operation may be repeated usually in three or four days. During the intervals between succeeding operations, the patient may be allowed to take a certain amount of exercise.

It is of considerable importance to determine how much should be done at each operation; on this question Surgeons differ. Some do a great deal, whilst others are satisfied with seizing the stone only once or twice, and repeating the

operation at much shorter intervals. Some place the patient under the influence of chloroform, and continue seizing and crushing the stone until the whole is broken up, at one operation. This latter plan is accompanied with this disadvantage: where a large stone is thus crushed into pieces capable of being passed, the passage is liable to be blocked up with the fragments, which results in a difficulty in getting rid of them, and much consequent irritation of the parts. The wiser plan is to adopt an intermediate method, and to do at each operation so much only as the patient can bear without great inconvenience, so as to render as few operations as possible necessary; whilst, on the other hand, the patient is not distressed by the manipulations being continued too long at one operation. From five to ten minutes is the average time the lithotrite should be employed in the bladder.

The interval there should be between the performance of the operations, is the next question to be considered. As a rule, I never repeat the operation whilst any fragments are being passed, and I usually allow one or two days to elapse after the fragments have ceased to come away; this usually requires about a week between each operation.

With regard to the removal of the fragments by means of an instrument, I have found no reason to alter an opinion I formerly expressed, and which was published in the *Transactions of the Pathological Society* for the year 1850:

"In relation to the occurrence of infiltration of urine, and abscess after lithotritry, Mr. Charles Hawkins thus expresses himself: He believed this accident might be entirely avoided, if the operation of crushing be performed with the lithotrite,—that is, if the operator is satisfied with crushing the stone, and not attempting to withdraw the fragments between the beaks of the instrument. He believed this accident never occurred except where the urethra had been lacerated with a piece of stone during the withdrawal of the instrument; then impaction of a fragment led to the results which the preparations exhibit; but where the urethra has not been lacerated, impaction is of little importance, and no dangerous symptoms are likely to result from such an occurrence. . . . Since no attempts have been made to remove fragments from the bladder in the instrument, he had met with no such accident. . . . As far as his experience went, it was not necessary to attempt the removal of stone in the scoop-lithotrite. If the stone is *well crushed*, it may be left to nature for the bladder to be evacuated of the fragments; or where there was a difficulty in passing them, he had removed much by means of washing out the bladder." *Path. Trans.* part i. of vol. iii. 1850, pp. 123, 4.

It is not necessary to introduce the lithotrite more than once at each operation, if the plan described be adopted; nor is it requisite to draw off the water when the lithotrite is withdrawn. It is desirable that some water should be left in the bladder; it renders it better able to bear the presence of the broken stone. In performing lithotritry, this rule should be invariably followed: *to introduce an instrument into the bladder as few times as possible.*

When there is much enlargement of the prostate gland, and the patient on this account is unable to pass very small fragments, and their removal has not been effected by means of the catheter, the best mode of proceeding is to make use of the scoop-lithotrite; and one end of the sofa on which the patient lies being raised by an assistant, the fragments fall into the instrument at the fundus of the bladder, that part by this plan being now the lowest portion.

Among the difficulties that may arise during the treatment of a case are the following: Sometimes after the first operation retention of urine occurs, but not very frequently when the bladder is in a healthy state, and where too much has not been attempted: this must be met in the usual way, by the use of the catheter. A fragment of stone may be retained in the passage, after it has left the bladder, in cases where there has been no laceration of the parts: as before stated, this state of things, although troublesome, is not dangerous; and when the fragment lodges in the membranous or prostatic portion of the urethra, a full-sized gum catheter should be used, and the piece gently dislodged and pushed back into the bladder. Many ingenious instruments have been devised for the purpose of seizing and removing fragments thus arrested; but of all, the

catheter will be found the most simple and most useful. Should the fragment be retained in the anterior portion of the urethra, it usually makes its way out in a course of time; to facilitate this, the patient should retain the urine for as long a time as possible, and compressing the penis at the other side of the stone for a short time when the bladder is about to act, the piece is washed out. Fragments sometimes lodge just behind the meatus; with a common dressing-forceps they may be removed from this position; in a few cases it may become necessary to make a slight incision in the lining membrane of the urethra. The passing of fragments sometimes gives rise to inflammation of one or both testicles; this may delay the operation. The chief cause of mischief to be apprehended is when there is considerable irritation, followed by inflammation of the bladder, the urine depositing a quantity of ropy mucus, giving rise to great pain in the passage of water, and a constant desire to pass it. These cases require very careful treatment; depletion is rarely necessary: with the use of the warm bath and the administration of opium and hyoscyamus, the patient being kept to his bed or the sofa, the attack usually passes off. But these are signs that the bladder will not bear any lengthened operations. This state of bladder is sometimes caused by a fragment of stone, which is both too large and too small,—small enough to enter the neck of the bladder, but too large to pass further: in this case, notwithstanding the irritation that may be present, the lithotrite should be introduced and the fragment crushed, when generally the symptoms subside. The bladder will in many cases continue to secrete a quantity of ropy mucus as long as any stone remains, so that there is no reason for not proceeding with the operation; the patient may take daily half a pint of the decoction of Pareira brava; but the treatment really requisite is the removal of the stone. Nevertheless, these cases are occasionally not so easily managed, and sometimes it may be necessary to cease all operative proceedings for a time, until the bladder becomes in a more healthy state; it may, indeed, happen that the attempt to remove the stone by lithotritry must be abandoned: this, however, occurs but very rarely; usually, with proper treatment, these unfavourable symptoms are overcome, but not always. Sir Benjamin Brodie, in his *Notes on Lithotritry*, relates the following case:

“In a fourth case, a very small calculus was crushed with great ease by a single operation. The operation was succeeded by a rigor, which terminated, as is usual, in a perspiration. A disturbed state of the system followed, marked by a frequent pulse, a furred tongue, and much prostration of strength; and attended with a deposit of adhesive mucus, but not in large quantity, from the urine. These symptoms continued, and after some time an abscess presented itself in one groin. The abscess having been opened, a considerable discharge of matter took place, and was followed by great relief as to the general symptoms. The patient seemed to be in an improving state, when, between four and five weeks after the operation, he suddenly expired.

“On examining the body, no remains of the calculus were discovered in the bladder. The mucous membrane of the bladder bore marks of inflammation. There was an abscess of the pelvis, occupying the space between the bladder and rectum, and extending in the direction of the abdomen as high as the groin, in which the puncture had been made. The parts were carefully dissected and examined by the late Mr. Vincent (who had attended the patient with me in consultation), by Mr. Charles Hawkins, the Curator of the Museum of St. George's Hospital, and myself; but no lesion could be detected of the bladder, nor any kind of communication between the bladder or urethra and the abscess. Still I cannot doubt that the abscess was somehow the result of the operation. Probably a very small splinter of the calculus might have penetrated the coats of the bladder, allowing the escape of a very minute quantity of urine into the cellular membrane. This would be quite sufficient to account for an extensive suppuration, at the same time that it is easy to suppose that so small a puncture might at once have closed, so as to be invisible afterwards.”

In this case the cause of death I believe to have been fatty degeneration of the heart; and had this disease not existed, I have little doubt but that the patient would have got well of the operation.

In those cases where a fragment becomes impacted in the urethra, usually in the membranous portion, and where the parts have been lacerated, in all probability such an accident will be followed by infiltration of urine and perineal abscess; the Surgeon must lay open the abscess freely. In two cases where this treatment was followed the patient ultimately recovered.

The number of times it may be requisite to repeat the operation must necessarily depend upon the size of the stone—the amount of crushing that is performed at each operation—and the facility with which the fragments are passed. Some patients pass very considerable-sized fragments; others require the pieces to be very small, necessitating more frequent operations. In the cases operated on by Sir Benjamin Brodie, with those that have occurred in my own practice, the number of operations averaged between six and seven; one or two operations sufficing in many cases of small stones. Mr. Prescott Hewett has operated in one case as many as nineteen times, and with ultimate success.

It is occasionally a wise plan, in cases in which there have been many operations, and the patient begins to feel the confinement and the recurrence of the operations, to cease altogether for a time, so as to allow him to recover his usual health; of course before dismissing the patient as cured, the Surgeon must be satisfied, by examining the bladder, that no stone remains. In some cases where the fragments are too small to be seized by the lithotrite, or rather where from their size they fall through the opening in the blades of the instrument and yet do not pass, the introduction of a full-sized catheter (which should be retained in the bladder for a short time) will enable the patient to void them.

The placing the patient under the influence of chloroform is by some Surgeons much recommended. As a rule I do not think it advisable to make use of it, but only to have recourse to it in those cases where circumstances may render it necessary. In ordinary cases there is not only no occasion for it (for lithotrity, if properly performed, is not a painful operation), but, on the contrary, it is as well to do without it on account of the operator being thus better able to ascertain to what extent the patient can bear the operation at each time, so that he should not proceed so far as to cause the bladder to resent the operative proceedings. The bladder does not retain the water so well when chloroform is employed. When patients are peculiarly sensitive with regard to the operation, chloroform must be administered; for without it such patients could not be induced to submit to the operation, however favourable their cases might be in other respects. I operated on a patient twenty-four years of age, who had symptoms of calculus when a child. They had for many years remained dormant, but had recurred about four years before he consulted me, at which time he was making water incessantly and with intolerable pain, the urine depositing a large quantity of ropy mucus mixed with blood; in fact, the bladder being in as unpromising a state as possible for any operation. Having seized a very large stone with the lithotrite, I was unable to proceed with the operation on account of the patient being unable to exercise the necessary control over himself; but under chloroform I was enabled to effect a complete cure in five operations. It would have been impossible to have done this without the aid of chloroform. In the 41st volume of the *Medico-Chirurgical Transactions*, I have related a case in which I operated successfully on a patient in whom there was a communication between the bladder and intestine. The calculus, the nucleus of which was some vegetable matter, was of such a size that I could scarcely seize it with a very large lithotrite. The patient was enduring such dreadful sufferings that he was anxious to be placed under the influence of chloroform; but on the third occasion of operating, it was done, at his request, without chloroform; the operation was borne as well as when chloroform was used, and the bladder held more water. In such cases chloroform is very useful; but in the majority of cases it is not requisite, and not being requisite, it is as well not to have recourse to it.

In considering in what cases lithotrity is to be preferred to lithotomy, it may be observed that the early writers on the operation were of opinion that only where the calculus was very small, requiring but one or two operations—

the bladder and kidneys perfectly healthy—was lithotrity available. Further experience, together with the great improvement in the instruments used and in the mode of operating, have tended in a great measure to alter this opinion. No doubt but that the frequent introduction of instruments when the fragments were removed within the blades, causing unnecessary disturbance to the bladder, and the stretching and not unfrequently the laceration of the urethra, rendering it in a very unfit state for the passage of fragments, led to most dangerous accidents; but since the practice of removing the fragments within the blades of the instrument has been laid aside, many cases which formerly would have been unfavourable for lithotrity are now successfully treated. The inability of the bladder to expel all the fragments was also considered a state in which lithotrity was not applicable. Yet now, after the stone has been well crushed, these cases can be managed by washing out the débris through a silver catheter. It may be well to mention, that the eye of the catheter used for this purpose should always be on the concave side of the curve—for the reason, that if a fragment should chance to lodge in the aperture and not be removable, notwithstanding that on the withdrawal of the instrument the fragment might lacerate the urethra, the consequences that follow such an accident are of much less importance than if the lower part of the urethra were injured. A catheter has lately been invented with the opening in the convex part—for the injecting the bladder—under the idea that the stream of water coming more immediately in contact with the fragments, their removal is more readily effected; which is rather a theoretical than a practical improvement, and the catheter has the disadvantage of having the aperture in the lower curve. There is no doubt that a healthy state of the bladder is very desirable when lithotrity is to be employed; but I have performed it with success when the bladder has been in a very considerable state of irritation and secreting much ropy mucus. This irritation and secretion of mucus diminish as the operations are performed, and nearly cease before the whole of the calculus has been removed. These cases certainly require much caution in their management, still they are by no means cases in which lithotrity is to be rejected. The capacity of the bladder to hold the requisite quantity of water might at first deter a Surgeon from selecting such cases for the operation; but, on the other hand, a little management, by injecting the bladder for some time previous to operating, generally overcomes this obstacle, and not unfrequently, where a bladder has been very intolerant of water, this inconvenience has subsided after the stone has been once crushed. Where there is serious disease of the kidneys, lithotrity is no doubt as likely to be attended with ill consequences as lithotomy. But cases do occur where the presence of kidney disease would inevitably render lithotomy an unsuccessful operation, in which lithotrity may be employed, if not with entire success, with at least the alleviation of much suffering, and prolongation of life. The worst form of kidney disease, albuminurea, is fortunately not frequently found in combination with calculus in the bladder at the period of life at which it is desirable to perform lithotrity. In cases of very bad stricture of the urethra, rendering the introduction of the lithotrite impossible, lithotomy must be had recourse to; but in cases in which a considerable amount of stricture existed, I have been enabled, by using a small lithotrite and crushing the stone very fine, to relieve the bladder of a considerable-sized stone. Malignant disease of the bladder, in combination with calculus, of course precludes lithotrity as well as lithotomy.

The removal of foreign bodies that have been introduced into the bladder, such as bougies, may be effected with a scoop-lithotrite.

In cases in which the bladder is unable entirely to empty itself, the urine left soon becomes decomposed and ammoniacal, irritating the mucous membrane, and causing it to secrete a quantity of phosphate of lime, or phosphate and carbonate of lime, which, being mixed with the mucus and retained in the bladder, gives rise to great irritability of that organ. In such cases the removal of this soft calculous matter is easily accomplished by means of the scoop-lithotrite. But the cause of the mischief remaining, these formations will constantly recur, and in some instances give rise to the opinion that the Surgeon had failed in

the previous operation to remove the whole of the formations, which is not always the case. The treatment to be adopted to prevent the formation of calculous matter is the constant washing out of the bladder with warm water. These cases are usually very troublesome; and if this treatment is not persevered in, the disease of the bladder soon sets up disease of the kidney, under which the patient ultimately sinks.

Women are naturally, from the formation of the urinary passages, favourable cases for lithotritry; and the operation is to be performed in the manner that has been described previously for the other sex. The cure in women is less protracted than in men, as the fragments pass more readily. There are obvious reasons why it is desirable that women should be placed under the influence of chloroform. It may be said that with women, with hardly an exception, lithotritry is the method to be employed.

It is very generally admitted that children are not well fitted for lithotritry, and that lithotomy should in their cases be performed, not only on account of the great success attending that mode of operating at an early period of life, but also on account of the necessarily small size of the instruments to be used rendering it difficult to have them made of sufficient power to crush stones of the size frequently found in children, and the almost impossibility of carrying out in them the continuous treatment necessary to bring lithotritry to successful issue.

The composition of the stone is not a matter of very considerable importance; perhaps those composed of oxalate of lime require more force in the application of the lithotrite, and the fragments cause more pain in passing than others; but this is fortunately a calculus not very frequently met with.

In comparing the relative success of lithotritry and lithotomy, Sir Benjamin Brodie, in his *Notes on Lithotritry*, makes the following remarks:

"It would be unreasonable to expect that any method of treatment for the relief of a disease so certainly fatal if left to itself, and productive of so much misery, as calculus of the bladder, should be constantly and uniformly successful. If lithotomy has its dangers, lithotritry has its dangers also; and the only question for the practical Surgeon to consider is, which is the least dangerous of the two. Of the nine cases which I have enumerated, it may well be doubted as to one of them whether the attack which was the immediate cause of the patient's death was really connected with the operation; while in two others the fatal result was to be attributed to a mode of performing the operation which my later experience has led me to abandon. But, even if we admit the whole nine cases as a fair example of the average failure of the operation, the proportion of deaths to recoveries is somewhat less than 1 in $12\frac{1}{2}$.

"In order that I might compare this with the proportion of deaths from lithotomy, I have referred to a paper by the late Mr. R. Smith, of Bristol, published in the eleventh volume of the *Transactions* of this Society, and entitled 'An Inquiry into the Statistics of Stone in the Bladder;' and I there find it stated, that in the Bristol Hospital, during a series of many years, the average of deaths after lithotomy was 1 in $4\frac{1}{2}$; in the hospital at Leeds, 1 in 5; and in the hospital at Norwich, 1 in $7\frac{1}{4}$.

"Thirty-five years have elapsed since the publication of these statements, but there is no reason to believe that the success of lithotomy is greater now than it was when Mr. Smith collected his observations. The editor of a weekly journal (the *Medical Times and Gazette*) has for some time past published the statistics of the various operations performed in the London hospitals, including lithotomy. The facts seem to have been collected with some care, and are probably a near approximation to the truth. Mr. Charles Hawkins has been at the pains to collect from the various numbers of that journal, published during the year 1854, the facts relating to lithotomy; and it appears that of 59 patients who underwent that operation, as many as 10 died, being in the proportion of rather more than 1 in 6.

"But here two other facts must not be overlooked, without which no just comparison can be made of the results of the two operations. First, while cases of vesical calculus in children under the age of puberty, in private practice, and among the more affluent classes of society, are of rare occurrence, they form the

very great majority of those which are admitted into hospitals; and, secondly, the proportion of deaths after lithotomy among children is very much less than it is among adults. Both these facts are sufficiently obvious to those who have had the opportunity of witnessing the practice of our larger hospitals. From the data furnished by the medical journal to which I have already referred, it appears that in the London hospitals during the last year children formed a small fraction more than three-fourths of the whole number of those who underwent lithotomy; that among them the deaths were in the proportion of 1 to 14 recoveries; while among adults the deaths and recoveries were equal. That in this instance the large proportion of deaths among adults was beyond the average, and depending on accidental circumstances, cannot well be a matter of doubt, and indeed it is plain that no general rule can be drawn from the limited number of cases which occur in the space of a single year. Still, as even in the Norwich Hospital, where there is reason to believe that lithotomy has been on the whole more successful than in any other public institution, the proportion of deaths among adults is reported to have been four times as large as that among children,* it is evident that the difference in the degree of danger at these two periods of life is very great; and it must always be borne in mind that, in estimating the comparative value of the two operations, it is only the results met with in adults that should enter into our calculations."

There have not as yet been any very extensive statistics of lithotritry published. The latest are those of M. Civiale, of which Mr. Henry Thompson, in his work before referred to, says:

"Take, for example, the practice of my esteemed and kind friend M. Civiale during the last year. It is a fair specimen of his usual experience, which he is good enough to send me annually, and has of late presented to the Académie des Sciences. He treated, during the year 1862, 69 calculous patients—66 men, 2 women, and a child; 45 in private practice, 24 at Hôpital Necker. Fifty-eight of these were operated on: 45 were submitted to lithotritry; of these, 3 were partially cured, and it was successful in all the remainder but 1.

"Ten were treated by lithotomy; 3 were cured, 2 relieved, and 5 died. Three were treated by a combination of lithotomy and lithotritry; 2 were cured, the other has incontinence of urine.

"In eleven cases operative means have been adjourned or considered impossible.

"Now, although the lithotritry here recorded is extremely successful, every English Surgeon will feel surprised to find one in every six adult cases placed in the category last named, and one-half of the lithotomy cases fatal. It must be obvious to all who are familiar with the practice of this country, that nothing like this proportion of cases is adjudged unfit for operation."

Mr. Thompson also states that Mr. Crichton has performed lithotritry in 122 cases with eight deaths.

It will be seen by the tables so carefully prepared by Mr. Thompson, that in 1827 cases of lithotomy, 1116 occurred in patients between the ages of one year and twenty-one years, leaving but 717 from that period up to the age of eighty-one; and of these, 462 cases occurred between fifty and eighty-one years, the period of life (at least in private practice) we are most called upon to operate for stone; and in these cases there were 115 deaths,—about 1 in 4 cases. Now, if we compare these statistics of lithotomy with those as yet given of lithotritry, it will, I think, leave no doubt in most minds which operation the Surgeon should prefer, at least in the large majority of adult patients.

One of the great advantages of lithotritry is, that patients are quite ready to submit to the operation when the stone is small, and when its presence has not given rise to any serious mischief in the bladder or kidneys; when, on the other hand, an operation so serious and so dreaded as lithotomy is driven off, as a last resource.

In reviewing all the bearings of the two operations, I think there is every reason to concur in the opinion expressed by Sir Benjamin Brodie: "My own

* *Medico-Chirurgical Transactions*, vol. xi. p. 32.

experience has certainly led me to the conclusion that lithotrity, *if prudently and carefully performed, with due attention to minute circumstances*, is liable to smaller objection than almost any other of the capital operations of surgery. The cases, indeed, to which it is not applicable are very few indeed, and they are chiefly those in which, from the calculus having attained an unusual size, the danger and difficulty of lithotomy are so great that no Surgeon would willingly, nor otherwise than as a matter of duty, undertake it."

In conclusion, it may be well to consider how far it may be expedient, in arriving at a decision as to which of the operations should be adopted, to make some distinction between private and hospital patients. The greatest success attending lithotomy is undoubtedly met with in the latter class. These patients being willing to submit to an operation at an earlier period than those in private practice, are consequently in a more favourable state for lithotomy; and not being so amenable to the necessary treatment between the operations of lithotrity as the more educated classes (for lithotrity, although a simple operation in itself, requires, for a successful issue, great care and attention to the most minute points during the whole time the patient is under treatment), when the treatment becomes protracted, they are liable to become unfavourably influenced by hospital atmosphere. To hospital patients *time* is of much more importance than it is to the more affluent; so it may be considered more advisable to have recourse to lithotomy, on these accounts, in hospitals, when in private practice lithotrity would without doubt be the operation selected. Such at least may be the reasons why in hospitals lithotomy is as yet more frequently had recourse to in adult patients than lithotrity.

Being anxious to have accurate information as to the progress lithotrity was making in hospital practice in London, while these pages were going through the press, I applied for information on this point to all the London Hospitals, and was most obligingly and readily supplied with what I required from all, with the exception of the Hospital for Stone; the authorities of this hospital made no reply to my request. I must also state that the return from University College Hospital is not quite complete, as I failed to obtain any information from one of the Surgeons of that hospital. If the numbers reported from University College Hospital be compared with other hospitals of the same size, it will be seen that the number of cases unreported cannot be large. The absence of information from one Surgeon cannot in any great degree influence the result obtained by the subjoined table; from which it will be seen that out of 91 adult patients admitted, in two years, into the London Hospitals, with stone in the bladder, only 32 were treated by lithotrity: 6 underwent no operation.

Patients with stone in the bladder admitted into London Hospitals in the years 1862-63.

Hospitals.	Total.	Children.	Adults.	Lithotrity.	Lithotomy.
Guy's	31	15	16	7	24
St. Bartholomew's	25	16	9	3	22
King's College	22	7	15	9	13
London	17	5	12	2	15
University College	16	6	10	5	11
St. George's	13	2	11	3	8
St. Mary's	12	9	3	1	11
St. Thomas's	11	7	4	1	8
Royal Free	7	7	—	—	7
Middlesex	6	2	4	1	3
Westminster	5	3	2	—	5
Metropolitan Free	4	1	3	—	4
Charing Cross	3	2	1	—	3
Sick Children	3	3	—	—	3
Great Northern	2	1	1	—	2
	177	86	91	32	139

CHARLES HAWKINS.

SURGICAL DISEASES OF WOMEN.

IF, perhaps, we except diseases of the eye, no department of Surgery has made such great advance within the last fifteen years as that which concerns the surgical diseases of women. In the successful treatment of vesico-vaginal fistula, the permanent relief of prolapsus uteri by operation, and the radical cure of ovarian dropsy, we enumerate some of the most creditable achievements of modern Surgery.

The space allowed by the present work will not permit of any thing approaching to a full dissertation, on the various affections, peculiar to women, which require surgical treatment. I shall, therefore, endeavour to keep closely to the more important parts of my subject, having regard especially to those diseases which permit of relief by operation. The following will be the arrangement of subjects treated of :

Urethral hæmorrhoids.

Malformations of the vagina or uterus.

Uterine polypus.

Uterine fibroid tumours (in reference to surgical treatment).

Malignant disease of the cervix uteri.

Malignant disease of the external genitals.

Surgical measures in cases of extra-uterine pregnancy.

Ruptured perineum, and its consequences.

Organic diseases of the ovary, and their surgical treatment.

Vaginal fistula.

Urethral hæmorrhoids (vascular tumours of the meatus urinarius).

It is not uncommon in women of any age, though more frequent in young adults, for small vascular growths to occur just within the meatus. These are sometimes single, but often multiple. They may be pedunculated or on broad bases. Their most frequent site is on the floor of the meatus, but they may occur at any part. They rarely extend far inwards, but sometimes sufficiently so to make their complete exposure difficult. Those with broad bases resemble very closely in all particulars the more vascular kind of piles; but those which have become pedunculated are of more fragile texture,

and look more like small *nævi*. They are, however, never congenital, and in their mode of origin and real nature are probably analogous to anal piles. Their symptoms, also, making allowance for difference in site, are very similar to those of piles. Proneness to bleed, great sensitiveness, liability to become extruded and inflamed, pain during the escape of the visceral contents, are some which both diseases have in common.

The amount of suffering caused by these little growths is often exceedingly great. In some the pain is almost constant; in others it is only excited by irritation, as for instance the passage of urine over them. The quantity of blood lost may vary greatly, and in some cases, attended by great irritation, may be very trivial. If a woman complains of pain in passing urine, occasional bleeding and pain in coitu, an examination should always be made, and in most such cases a urethral hæmorrhoid will be found.

Very often the irritation produced by these little growths suffices to cause serious constitutional disturbance. In one instance I have known urethral or urinary paraplegia to result; but this event is probably extremely rare.

Those who have had much experience in the treatment of these cases will acknowledge that their complete cure is often not easy. Although the little tumours seem to be very superficial, they are not really so; and unless the submucous base is destroyed, they quickly and pertinaciously grow again. The ligature, excision, and the cautery, either singly or combined, are our chief means of combating them. Whatever method is adopted should be boldly used. The application of any so-called mild caustic, as the nitrate of silver or sulphate of copper, can be productive only of mischievous irritation. The best caustics are the actual cautery or the acid nitrate of mercury; and of these the first is the most manageable, especially if a galvanic apparatus be employed. On the whole, perhaps the ligature is the most trustworthy plan. It must be applied by means of a fine tenaculum, by which the base of the tumour from behind forwards has been deeply transfixed, and over which the silk is applied. If only the crest of the growth be tied, the plan is worse than useless. By whatever plan we propose to operate, it is desirable that the patient should be under chloroform, and in the lithotomy position, and that the meatus should be well opened by means of bent probes.

Malformations of the vagina or uterus. Cases of closure of the outlet of the vagina by adhesion of the labia in the middle line are not unfrequently brought under the notice of the Surgeon. In these the anterior part is almost always open, so that there is room for the escape of the urine. The defect is usually discovered by the mother or nurse early, and the patient comes under care either in infancy or early childhood. At this age the adhesions are rarely strong, and may commonly be broken down by a director. The insertion of a strip of oiled lint prevents reuniting of the edges, and the cure is complete.

Ruysch and Delpech have each recorded a case in which adhesion of the labia was the cause of retained menses. In Ruysch's case, if not in both, there is, however, reason to doubt whether the occluding membrane was not an unusually thin and distended hymen. I have seen the hymen in cases of great distension protruded external to the vulva.

In those cases, however, in which the vagina is closed higher up than the external outlet, the defect is but seldom discovered until menstruation is established. Very frequently the case is allowed to pass on until a large accumulation of retained menstrual fluid has taken place before advice is sought. Amongst the causes which may give rise to closure of the vagina we may class congenital malformations, imperforate hymen, and adhesion of the walls of the tube consequent on ulceration in early life. The first and the last are much less frequent than the second. It is scarcely necessary to point out that if by chance the fact of the existence of vaginal occlusion should come to the Surgeon's knowledge prior to the establishment of menstruation, an early operation is very desirable. We shall have to show very shortly that even the simplest operations, when performed after menstrual accumulations have taken place, are attended with peculiar danger.

In any case of vaginal obstruction it is desirable, first, to ascertain the character, thickness, &c. of the occluding medium; and secondly, to determine, if possible, whether the uterus be present. In a large majority of cases the existence of an abdominal tumour, believed to be an intra-uterine collection of menstrual fluid, at once sets the latter question at rest.

The determination of the presence or absence of the uterus is in certain cases exceedingly difficult. If, however, the patient have attained adult age, and there have been no menstrual effort, and if on careful examination by the vagina and rectum the organ cannot be felt, a strong suspicion must be entertained that it does not exist. This suspicion will be strengthened if the vagina below the occlusion be much contracted, and if the walls of the bladder and rectum above it can be ascertained to be in near contact. The development or otherwise of sexual characteristics is of little value as a symptom, since it depends more upon the state of the ovaries than upon that of the uterus. Should there appear good reason to fear that the uterus is absent, and that the case is one of non-development of that organ and of the upper part of the vagina, no operation should be attempted, since any incisions of sufficient extent to clear up the doubt would be attended with much danger.

When there is evidence of the retention of menstrual fluid, and therefore of the presence of an uterus, and probably of a vaginal cavity above the occlusion, the case will come fairly under surgical treatment. In the first place, the character of the obstructing medium must be determined. If the obstruction be found within an inch or two inches of the vulva, and if it be constituted by a membrane, more or less thick and unyielding, stretched across an otherwise well-formed vagina, the case is probably one of imperforate hymen. In some of these, during coughing, the propulsion of the fluid downwards may easily be felt, or the distended membrane may even be forced as low as the vulva itself. In these cases the operation is in itself easy and simple, though, as we shall see shortly, by no means devoid of risk.

The method of operating in a case of imperforate hymen has usually been to make an incision of a crucial form in the centre of the membrane. The patient having been placed in the lithotomy position, is desired to force downwards, so as to distend the occluding structures, and a bistoury is then plunged into the centre. The opening thus made is subsequently widened, the finger being introduced and used as a director. If there be considerable redundancy of thin membrane, it may be feasible to dissect part of it away; but if otherwise, the free crucial incision will be amply sufficient, and will not be attended by any subsequent inconvenience, due care being taken to prevent contraction during the first week or two. Mr. Baker Brown has advised strongly that the hymen should in all cases be dissected away; but it is impossible to believe with him that, when this is not done, "vaginitis is very apt to be set up by the friction of the surfaces upon each other," and that "this inflammation may extend to the uterus, Fallopian tubes, and peritoneum." Most Surgeons will probably incline to the opinion that a free crucial opening is likely to incur less risk of inflammation than an operation in which "the hymen is removed entire by a circular incision;" nor is it needful to point out which of the two methods most closely imitates nature's procedure.

That a free crucial incision is amply sufficient as regards providing free space for all the functions of the tube, there can be no practical doubt. Indeed, since no mucous membrane is removed, it is probably less likely to be followed by any thing like cicatricial stricture than would the plan proposed by Mr. Brown. In one case in which I adopted the crucial incision, and in which the diaphragm was very thick, the patient subsequently married, and has since borne several children. At the present time there is not the slightest perceptible narrowing of the vagina at the part.

Although, however, the operation in cases of retained menses from imperforate hymen is easy enough, yet clinical experience has shown that it is attended by much danger to life. In a very considerable proportion of such cases, within a few days of the operation, peritonitis comes on, and death ensues. Whence this risk? That it is not connected with the extent of the incisions or the nature of the parts incised, is quite evident; for it has occurred in some in which nothing was done excepting the making of a mere puncture in a thin membrane. Nor can it be attributed, as Dr. Blundell suggested, to a disease derived by contagion analogous to puerperal peritonitis, since it has happened in private practice and in districts in which no puerperal disease was prevalent. Let me cite the following example, which came under my own notice. A very healthy girl, aged 16, residing at a village near York, came under treatment in May 1851, on account of retained menses. On examination a round elastic tense body, the size of an orange, was found protruding between the labia. A common lancet was plunged into the centre of this swelling, and a stream of dark treacle-like fluid without smell followed. About two quarts were discharged. On the second day after the incision slight chilliness occurred; on the third she was feverish, and the vaginal fluid had an offensive smell. On the fifth day the existence of peritonitis was very evident; and she had a rapid pulse and foul tongue. From this date she passed into a condition of low irritative fever, attended with much sickness, &c.; and death took place on the twenty-fourth

day. No post-mortem examination was obtained. It was impossible that less would have been done, or under more favourable circumstances, than in this case. Yet it is a good example of what often follows the puncture of an imperforate hymen. In some, death takes place even within a few days of the operation (if such it can be called); whilst in a few the patients, after severe peritonitis, ultimately recover. If ill symptoms have, however, once set in, the chance of recovery is small; the cases which do well (happily a large majority of the whole) usually progress from first to last without any drawback, and without the slightest indication of peritoneal irritation.

Two suggestions occur by which to explain the danger attending this operation. First, it may easily be supposed that the retained menstrual fluid is in a condition peculiarly apt to undergo decomposition as soon as air is admitted, and not unlikely when decomposed to induce a form of endometritis, which might pass on to a condition closely analogous to that of puerperal fever. The second explanation is one that would not have occurred to the mind had it not been demonstrated by post-mortem observation. It is, that some of the retained fluid finds its way upwards through the free extremity of the Fallopian tube into the sac of the peritoneum. That in cases of retained menses the Fallopian tubes, as well as the uterine cavity, are often very greatly dilated, has been repeatedly witnessed. But why should a dilated tube which never permitted the escape of its contents before the operation do so afterwards? It might have been supposed that, prior to the incision of the occluding membrane, and that especially during the state of tension produced by a menstrual nixus, the risk of extravasation upwards would be considerable, and that it would cease at once when an outlet downwards was provided. The clinical fact is, however, the reverse; and whilst it is very rare for such escape to take place prior to the incision of the hymen, it is by no means infrequent within a few days afterwards.

To MM. Bernutz and Goupil* we are indebted for the best collection of facts and arguments bearing upon this part of our subject. In some instances there has been found evidence of ulceration at or near the free extremity of the Fallopian tube, but in others the fluid could only have escaped from the free extremity itself. Sir Benjamin Brodie† has mentioned two cases in which peritonitis followed this operation. In one, the patient with difficulty recovered; in the other, death took place. At the autopsy in the latter a large quantity of menstrual fluid was found in the abdomen, but there was no rupture either of the uterus or of any part of either Fallopian tube. In a case recorded by M. Locatelli, and quoted by MM. Bernutz and Goupil, full details of the autopsy are given. In this case death followed on the third day. One Fallopian tube was found dilated to the size of a nut, the other to that of a turkey's egg. The latter had ruptured behind, and in the peritoneal cavity was a small quantity of black half-putrefied blood, exactly similar to that contained in the tube. The dilated tubes were adherent to their respective ovaries, and communicated with the uterus by extremely narrow canals. Mr. Paget of Leicester has also published a case in which a young lady of eighteen died on the fifth day after an incision through an imperforate hymen. At the autopsy the Fallopian tubes and ovaries were found dilated, until each would have held a pint of fluid. Both these tumours had ulcerated and given way, the edges of the openings looking as if recently torn. In the peritoneal cavity was a pint and a half of black fluid, exactly similar to that removed from the vagina.‡

In proof that rupture of the distended Fallopian tube may occasionally happen without any operation having been performed, is a case given by Dr. Munk,§ in which a girl of eighteen, who had never menstruated, died after a three-days illness, with symptoms of acute peritonitis. There was found after

* See their excellent *Clinique Médicale sur les Maladies des Femmes*; article, Rétention du flux menstruel.

† *Lond. Med. Gaz.* vol. xxvii. p. 810.

‡ *British Medical Journal*, July 23, 1859.

§ *Lond. Med. Gaz.* vol. xxvii. p. 867.

death an imperforate vagina, consequent apparently on cicatrical adhesions. In the peritoneal sac was a large quantity of thick blood, of similar character to that which, to the quantity of about five ounces, occupied the uterine cavity. Both Fallopian tubes were dilated sufficiently to admit a finger, and near the extremity of the left was a small laceration, from which the fluid had escaped.

These cases illustrate clearly one of the dangers to which patients after this operation are exposed. The only explanation which can be given as to why these Fallopian lacerations should be so prone to occur immediately after operations is, that the uterus, by its contractions after evacuation, may possibly drive a certain portion of fluid backwards. It may easily be supposed that the tubes already distended and thinned are unable to empty themselves quickly, whilst a powerful organ like the uterus, excited to contraction by the escape of its contents, would rapidly do so, and thus close the apertures of communication.

As I am not aware of any published cases of death after incision of imperforate hymen in which there was post-mortem proof that no rupture of the tube had taken place, it seems probable that this occurrence is the main risk which we have to encounter. The problem, how to obviate it, is one of great difficulty. It is not practicable to avoid such operations altogether; and were it so, as Dr. Munk's case proves, no immunity could be obtained. Sooner or later the dreaded event would probably take place. To make a very small incision, and thus allow the fluid to drain slowly off, instead of at once permitting the uterus to empty itself, has been proposed, and with much plausibility. To accomplish this, the introduction of a small drainage-tube by means of a trocar and canula would perhaps be the best method. Still it is probable that, however slow the escape was, the uterus would claim preference for itself, and might be expected to act energetically throughout the whole time, altogether preventing the evacuation of the thin and feebly muscular tubes. With the view of retarding this action, it might possibly be well to put the patient before the puncture under the full influence of tartar emetic, and to keep her nauseated for twenty-four hours afterwards. Under such circumstances the freer the opening the better. With the hope of anticipating the dilatation of the tubes, early operations should always be performed in cases of occluded vagina.

The above statements apply to all operations in which there has been retention of menses, whatever may have been the cause. Probably they include the only source of danger to which, in simple cases of imperforate hymen, the patient is exposed. In cases of obliteration of the vagina, however, other risks attend any attempt at operative relief. In these cases the operation is in itself a more or less difficult process of dissection, and there is danger that either the bladder, the rectum, the vagina, or even the peritoneum itself, may be wounded. No two cases are alike, and it is impossible to lay down rules for the Surgeon's guidance, beyond insisting upon the necessity for ascertaining as exactly as possible the thickness of the occluding tissues, and the relative position of the bladder and rectum. It is surely, when doubt is present, better to dissect cautiously than to employ a trocar. About four years ago I had the pleasure of performing, in consultation with Dr. West, a successful operation in a case of this kind which had given us much anxiety. The young lady was the daughter of a Surgeon, himself only too well aware of the peculiar risks which attached to the procedure. The vagina was about an inch and a half in depth, ending in a cul-de-sac. In the rectum a fluctuating and very tense tumour could be felt; but below this the bowel and the bladder were in almost close apposition, and the uniting structures were very firm. The operation consisted in dissecting through the septum very cautiously, all the incisions being made from side to side, and the forefinger being kept in the wound to press back the bowel. At length the upper cavity of the vagina was reached, and a gush of thick tar-like fluid escaped. The os uteri was found closely united to the septum just above the opening. The incision was enlarged sufficiently to allow of the free escape of the fluid; but in the subsequent management of the case it was needful to employ sponge tents to keep it open. The patient recovered without ill symptoms, and has ever since menstruated regularly and without pain.

The importance of attending to the opening for some weeks or even months after the operation is proved by the fact, that occasionally second operations have been requisite; and in one case, a patient who had survived the first died after the second.

In rare instances, if it be not thought practicable to reach the uterus from the vagina, puncture of the tumour per rectum, and the establishment of a recto-uterine fistula, may be desirable.

Cases in which the cervix uteri itself is the part which is obliterated occur every now and then, and require surgical relief on account of retained menses. Their management must be conducted on the same general principles as in obliteration of the upper part of the vagina, from which, indeed, it is often difficult to distinguish them.

Uterine polypus. Hæmorrhage is by far the most important sign of polypus uteri. Whenever the symptom of frequent and irregular discharges of blood from the vagina is present, and has lasted for some time and resisted ordinary treatment, the Surgeon should on no account defer an examination. The speculum as well as the finger should be used. In such cases, if the conjecture has been correct, one of the following conditions may be found: (*a*) a sessile soft growth of small size, containing one or more mucous cysts,* consisting of enlarged uteri follicles and hypertrophied cellular tissue; (*b*) a pedunculated growth of small size (a bean to a nut), soft, vascular, and often multiple, consisting of pendulous mucous membrane, and analogous to the mucous polypus of the nares; (*c*) a growth of finer texture and larger size than the latter (a nut to an egg), more or less pedunculated, and made up of mucous membrane, with a large excess of cellular tissue; (*d*) a much firmer growth than any of the preceding, and usually a much larger one, either pedunculated or sessile, its attachment usually passing up into the interior of the womb—the common fibrous polypus. We will omit for the present all varieties of malignant disease, any of which may occasion hæmorrhage, and in rare instances may even form a growth of somewhat polypoid shape; and also those cases of fibrous tumours in which the growth is as yet embedded in the exterior walls, in which latter hæmorrhage is also a most important sign.

Women of all ages are liable to the development of uterine polypi, but these growths are much more common during the period of menstrual activity than either in very early or in later life. In addition to the bleeding usually caused, we have in most cases leu-

* Now and then pedunculated cysts attached to the cervix uteri constitute polypi. Dr. Robert Lee has stated that one of the glandulæ Nabothi may be converted into a cyst as large as a walnut, or even a hen's egg," and hanging by a slender peduncle. *Medico-Chirurgical Trans.* vol. xix. p. 127.

corrhœal discharge, and more or less of bearing-down pain. The amount and frequency of the hæmorrhage is often diminished when the polypus escapes from the grasp of the cervix; and it also, as a rule, lessens in proportion as the pedicle becomes longer and thinner.

In addition to the four varieties of simple polypus above mentioned, we have in rare instances a form of tumour developed within the cavity of the uterus which is closely analogous to the recurrent fibroid in other parts. This tumour grows rapidly, assumes a polypoid form, attains a large size, and causes much bleeding. It can scarcely rank with true cancers, because it does not induce enlargements of the lymphatics or secondary deposits; but it differs from all the forms of simple polypus, in that it persistently grows again after removal. It, like the fibrous polypus, may have its attachment high up in the interior of the uterus.

The surgical treatment of small polypi is usually sufficiently easy. They may be removed by scissors, by torsion, by ligature, or by the *écraseur*. In all cases in which the pedicle is long and thin, either to snip it through with scissors, or to twist it by means of forceps until it gives way, is the best plan. There is little or no danger of serious hæmorrhage. The operation should always be performed with the part well exposed by means of the bivalve speculum. In the case of the softer and more sessile forms it will be well to follow a practice strongly recommended by Dr. West, and touch the cut surface with the solid nitrate of silver. Unless the fear of bleeding renders the ligature the only safe plan, it is better to avoid it, as we escape by doing so the disagreeable consequence of a fetid mass remaining for some days in the vagina.

The position of the attachment of the polypus is of great importance in deciding what method of treatment should be adopted. As a rule it may be stated, however, that all the forms excepting the fibrous and recurrent fibroid are attached low down, either to one lip or just within the cervix. If the attachment is high in the cervix, it may become desirable to dilate the latter by the use of sponge tents.

The fibrous (or, more correctly, musculo-fibroid) polypus is the most common, and as it is the only one (the very rare recurrent form excepted) which attains to a large size, it is the only one which for its safe removal requires any large amount of surgical ingenuity. The pathology of this form is now well understood, and it is generally recognised as consisting of an ordinary uterine fibroid growth, which has passed downwards, receiving an investment of mucous membrane. Dr. West has, however, directed attention to the fact, that in some cases the fibrous tumour which has become polypoid is not separable from its investment, but is continuous with the uterine tissue. This is very exceptional. Although prone to cause profuse bleedings whilst *in situ*, neither the substance of a fibrous polypus nor its investing membrane contain any large vessels. No fact is more clearly proven by clinical experience than that these tumours, when cut into, or when detached by section of their pedicle, do not cause any dangerous amount of hæmorrhage.

If a fibrous uterine tumour has become pedunculated and is the source of bleeding, it is the Surgeon's duty to remove it. The procedures by which its removal may be effected are three: by ligature, by excision, or by the *écraseur*. A large majority of Surgeons of the present day who have had much to do with these cases have recorded opinions adverse to the use of the ligature. If the pedicle be large, the ligature requires some days to cut its way through, and

during that time the patient is exposed to the inconvenience and danger of a decomposing mass lodged in the vagina. This source of risk is not chimerical. A large fatality has attended the use of the ligature in the hands of all who have employed it much. Of twenty cases recorded by Dr. Robert Lee, nine ended fatally. This proportion is probably too high; but almost all Surgeons will be able from individual experience to attest the fact that deaths do not unfrequently follow its use. Dr. Simpson of Edinburgh, and Dr. McClinton of Dublin, have both recorded facts and opinions adverse to the ligature. On the other hand, Dr. West states, that of twelve cases in which he practised excision, all recovered without either hæmorrhage or any untoward symptom; and DuRoi, Velpeau, and Lisfranc have given similar testimony based on larger collections of facts. I am not aware that any cases of fatal hæmorrhage have been recorded. If, however, any fear should still be felt on this score, we have the écraseur, by which the gains of both methods may be combined, and the tumour may be taken away at the time without any risk of hæmorrhage. It is, however, often difficult to apply, and always tedious in action.

The operation of excision may be thus performed: The patient should be in the lithotomy position, and the tumour should be carefully drawn down by forceps or hooks into the external parts. Not unfrequently its pedicle may be brought almost to a level with the vulva, and then it is easily cut through with scissors.* If, however, it cannot be got so low, the scissors may still be quite safely used, the vagina being opened by a duck-billed spatula, and the forefinger of the left hand employed as a guide. Various forms of knives, mostly bent at the end, have been contrived for the special purpose of severing the pedicle in cases in which it is unusually high up. Sometimes, even after the tumour has been detached, much difficulty is encountered in removing it from the vagina. Dr. West mentions that he has been compelled to resort to midwifery-forceps for that purpose; and the same necessity has occurred to myself.

After the removal of a fibrous polypus the stump of its peduncle will wither, and there is no risk whatever of recurrence. As, however, fibrous tumours of the uterus are often multiple, it is very possible that a second may descend and become polypoid. The recurrent fibroid polypus is, like its allied growths in other parts of the body, very prompt and pertinacious in its return. It is, indeed, difficult, if not impossible, to effect its complete removal. But three examples of this form of growth are on record. In one treated by Dr. Atlee of Philadelphia, between 1846 and 1851, four operations were performed, and with the result probably of greatly protracting the patient's life. In my own case two incomplete operations were performed within six months, and after each the patient was temporarily much benefited; she died, however, within three years of the first appearance of the growth.† The third case is recorded by Dr. West.‡ In it nine incomplete attempts at removal were made within about fifteen months; but although the tumour was greatly diminished, it was never wholly got away. Death took place nearly four years after the last, and more than six from the first appearance of the disease.§ Dr. West, who gives an excellent résumé of our present knowledge of these cases, concludes respecting the treatment: "It may, however, be doubted whether our wiser course is not to let the disease alone; for while its complete removal seems impossible, its partial extirpation seems to be followed by an increased rapidity in its production." It may be added, that treatment by caustic injections into the substance of the tumour was tried, both in Dr. West's case and my own, but without good results.

* Whenever it is needful to use scissors or forceps high up in the vagina, it is a convenient plan to protect their hinges, &c. by drawing over them a piece of sheet india-rubber, sewn so as to form a tube of requisite tightness. In this way only the end of the blades need be left exposed, and there is no risk of folds of mucous membrane getting crushed in the joints, or between the upper parts of the handles.

† *Pathological Society's Transactions*, vol. viii. p. 287, with plates showing the connections of the base of tumour to the uterine walls, and also its microscopic elements.

‡ See *On Diseases of Women*, p. 331, et seq.

§ For account of the autopsy (by Mr. Callender) see *Path. Trans.* vol. ix. p. 327.

Fibrous tumours of the uterus, in reference to surgical treatment.
It is chiefly in reference to the feasibility of attempting their removal by enucleation that fibrous tumours of the uterus become of interest to the Surgeon. Although in many cases these tumours occasion but little inconvenience, and it is not at all uncommon to find them embedded in the uterine wall or pedunculated in the abdomen in cases in which their presence had never been suspected during life, yet in other instances they cause constant suffering, and imperil life. When we remember that they possess, in the majority of cases, but very slight connexion either vascular or fibrous with the uterine structures, it is not to be wondered at, that attempts to enucleate and remove them should have been made. It is, however, chiefly within the last twenty years that this mode of dealing with them has been resorted to; and hitherto, with the exception of Dr. Simpson, Mr. Teale, and Mr. Baker Brown, but few British Surgeons have been bold enough to attempt it. In France, Lisfranc, Jarjavay, Amussat, and Maisonneuve, and in America, Dr. Atlee, have advocated and practised it, the experience of the latter Surgeon being indeed almost equal to that of all the others together. It is clear that attempts of this kind will vary much in their difficulty and in the danger attaching to them, in proportion as the tumour may protrude into the uterine or vaginal cavity. The distinction between a "fibrous tumour" and a "fibrous polypus" depends solely upon the position of the growth in regard to the uterine walls; and in proportion as the tumour approaches the pedunculated or polypoid form, does its removal become easy. I shall enter at some length into the details of the enucleation process, not from any wish to advocate its claims to more frequent adoption, but because, as in some rare cases, it is certainly advisable, it becomes desirable, that all the light which can be derived from past experience should be made available. In the *Medical Times and Gazette* for August 1857, I published, in a tabular form, all the cases of enucleation operations which I could collect. They amounted to thirty-nine, the greater portion being either Continental or American. Upon the careful examination of these cases the following remarks are based.

First, let me remark that enucleation operations may be conveniently divided into two groups, since in some the intention has been to remove the tumour at the time, in others only to disturb its relations and inflict such injury upon its vitality as to induce its sloughing. By the latter method several operations, after intervals of time, are usually requisite. The former, of course, give us far

more serious operations; but in the latter the process is a gradual one, and therefore the risk attending it is protracted over a much longer space of time. If the indications of the following table might be relied on, it would appear that the gross risk of the two modes is almost equal, and that, under either, about two-thirds of the cases end in recovery. We must examine the comparative merits of the two in a little more detail. Of the thirty-nine cases above alluded to as recorded in the *Medical Times and Gazette*, the following is a statistical summary :

Method pursued.	Number.	Recovered.	Died.
Primary enucleations (completed) . . .	18 . . .	12 . . .	6
Ditto (attempted but not completed) . . .	6 . . .	4 . . .	2
Enucleation by inducing gangrene . . .	15 . . .	9 . . .	6

Primary enucleation. Were certain cases in which enucleation by gangrene has been practised in Edinburgh added to the above table, that method would, it is believed, compare with still less advantage with the primary mode than it now does. But the truth is, that the cases in which it was pursued have been, as a rule, much more serious ones than those in the first list. In most the tumour was of very large size, and either actually embedded in uterine tissue, or at any rate wholly enclosed within the cavity of the womb. Under the head of "Primary Enucleations," on the other hand, are included several cases in which the tumour was of small size (less than a pear), and several others in which it was already somewhat polypoid in shape, having been partially extruded by the spontaneous contractions of the organ. In these, of course, the danger to life would be but comparatively little. Of cases in which the tumour was of considerable size, intra-parietal, and not protruding either into the uterine cavity or the vagina, and in which, consequently, primary enucleation was undertaken under the most dangerous circumstances, we have thirteen; and of these, seven ended in recovery, and six in death. In the less serious class, those, namely, in which either the tumour was small in size or already projected considerably, we have ten, out of which only two ended fatally; and of these two, in one the tumour, although projecting into the uterine cavity, was so large that its removal had been found impracticable. It is evident therefore that in cases in which the two conditions of moderate size and of somewhat depending position are combined, the operation of primary removal by incisions and the use of the finger is attended by very little danger. In those in which the growth is of large size and completely embedded, the chance of recovery after its removal is about equal to the risk of death. In the largest of all, those, for instance, in which the tumour approaches the size of an adult head, no Surgeon would ever dream of primary enucleation. Among the causes of death, we find peritonitis and inflammation of the pelvic cellular tissue to be by far the most frequent. The hæmorrhage, with one or two exceptions, is stated to have been insignificant; and very few appear to have died directly from the shock of the operation. Although in several the operators state that they felt themselves at the time in great risk of lacerating the peritoneal investment of the uterus, where spread over the surface of the tumour, yet that accident does not seem to have ever actually occurred. In only one case is it stated that any serious hæmorrhage continued after the operation was concluded. Among the cases which recovered, in not a few the patients were very ill indeed, and had narrow escapes of death, either from peritonitis or exhaustion.

Mode of performing the operation. Whoever has either witnessed its performance, or read the detailed accounts given in some of the French narratives, will have no difficulty in admitting that the enucleation of a large embedded uterine tumour is an operation which calls into requisition first-rate surgical endowments. In not a few on record it occupied between two and three hours

in its performance, and presented such obstacles that the operators were repeatedly on the point of relinquishing their task. The circumstance that these tumours not unfrequently occur to single women, in whom the vagina is narrow, often adds to the difficulties of a case. It is of course impossible to give rules which should be applicable to all; but the following memoranda are the result of much investigation, and a careful perusal of all that has been recorded, and will probably be useful to any one who may contemplate its performance for the first time.

1st. To have the tumour well depressed into the pelvis by an assistant. 2d. To let the first incisions be very free, and pass deeply into the tumour, thus not only completely dividing its capsule, but facilitating its bisection, should that afterwards be found requisite. This first incision should be made with a scalpel. In most cases it will be found convenient to pass the knife into the uterine cavity, and then, turning its edge on to the tumour, cut downwards, and either forwards or backwards, according as the mass may occupy either the anterior or posterior wall. All experience goes to show that no important hæmorrhage is to be feared from this incision, and if directed in the manner indicated, the whole substance of the tumour will intervene between the knife and the peritoneum. 3d. The capsule of the tumour having been opened, its separation should next be effected by means of the finger, or, if needful, by blunt-pointed curved scissors, the finger being used as a director. 4th. The Surgeon should be provided for this part of the operation with a set of curved scissors of various sizes and shapes; one pair at least should be very long indeed. He should also have several pairs of strong and large vulsella, a spatula, a blunt hook, a scoop, and a pair of small midwifery forceps. In some cases the operator appears to have been baffled for want of vulsella of proper size and strength for securely holding the tumour. A strong whipcord ligature, and the various appliances for its use, should be in readiness in case of need. 5th. The grand object of the operator, after having separated the tumour from its cyst-wall sufficiently to allow of its lower part being seized, is to invert the uterus, and drag that viscus, together with the tumour, to the external parts. If this be accomplished, the main difficulty of the operation—that, namely, of working in a confined space—is overcome, and a speedy conclusion may be effected. To do this, a large vulsellum should be carefully planted in the mass, and traction, at first gentle, afterwards vigorous, must be exerted. The axes of the pelvis must of course be carefully observed, and the traction must be steady and not by jerks. As soon as practicable, a second vulsellum must be placed above the first, or if more convenient the midwifery forceps may be employed. 6th. After eversion has been accomplished, an examination with the finger in the rectum should be made, and the relative position of parts having been duly ascertained, the remaining attachments of the tumour must be cautiously separated. The utmost care must be exercised not to cut into an inverted pouch of peritoneum. 7th. It is very possible, if the tumour be a large one, that it will be found convenient, before drawing it down, to cut away a portion or portions, and thus diminish its bulk. 8th. It is needless to remark, that throughout the utmost patience must be exercised, and as much gentleness as is consistent with the requisite degree of force. 9th. The operation complete, the everted uterus must be returned; if needful, a sponge-plug should be introduced, and a full dose of opium should be given. 10th. The use of ice, of the ergot, and of diffusible stimuli, must be resorted to, or not, according as circumstances may require.

Enucleation by inducing gangrene. This method, if we count those in which primary enucleation was attempted, but could not be effected, and include also a few others not yet on record, has been performed in about 27 cases; out of these there have been about 13 deaths, 10 recoveries, and 4 incomplete cases, in which either it was known that the whole of the tumour had not come away, or there was a return so soon as to render it highly probable that some part had been left behind. Almost all these were cases in which the tumour was of very large size, and in several the operation was undertaken on account of immediate urgency, and after the patient had been reduced to the very lowest stage by hæmorrhage. Thus it appears probable that of cases of this class somewhat

more than one-half may be expected to come safely through the risks incident to the procedure, and rather less than half to result in complete cures. It must be borne in mind that a large majority—indeed, almost the whole—were out of all possibility of treatment by the primary method. This plan has the recommendation of being an attempt to imitate nature. Although confessedly very infrequent, yet cases have occurred in which fibrous tumours of the womb have sloughed, and been extruded from their bed without the assistance of the Surgeon.* A far more common event than this is for them to become pedunculated, and assume the polypoid form, without wholly losing their connexions to the uterus. Although but few facts exist on which to ground a positive opinion, yet judging from those which have fallen under my notice, I suspect that the fatality of the cases in which spontaneous extrusion has occurred has been little less than that of those in which it has been induced artificially. The process is one always attended with much constitutional irritation. Although no single operation is required in itself involving much risk, yet with a large sloughing mass in such an important position, with fœtid discharges continuing for several weeks, the patient is kept for a considerable time in constant danger of the development of some fatal complication, in the form of pyæmia, peritonitis, or a low type of inflammation of some of the internal viscera. Repeated, if not almost daily, manipulations are needed, and the increased risk of some contagion, either of erysipelas or pyæmia, being thus conveyed by the Surgeon, must not be lost sight of, especially if the patient be an hospital inmate.

Then, again, it must be borne in mind that the patient has been reduced by long-continued hæmorrhage, and that in all probability her vital organs are already, to some extent, in a state of fatty degeneration; a condition which, under the evil influence of profuse suppuration, is not unlikely to become rapidly advanced to a degree incompatible with continuance of function. These kinds of risks render the operation one which will always be attended with much danger, and it must be admitted that it is one which ought never to be performed in a hospital ward. A healthy locality, and privacy in a large, well-ventilated room, with the undivided attentions of a nurse, should be regarded as essential conditions. With these, and with most persevering attention to all minutæ of the medical and dietetic management of the patient, it may, perhaps, be reasonably expected that the mortality, even in severe cases, might not exceed a third; but there are certainly, thus far, no grounds for expecting better success than this.

With regard to the plan of operating, it would appear that the knife possesses great advantages over escharotics. The object is as much as possible to separate the adhesions of the tumour from its cyst, and to thus cut off its vascular supply. Now the effect of the application of escharotics is well known to be to induce the union of subjacent parts, and of this the Surgeon not unfrequently avails himself; as in the instance of abscess in the liver, requiring to be opened externally. The dread of hæmorrhage from the incisions has been proved to be for the most part a chimera, and the prevention of this is, as far as we can see, the only shadow of an advantage which can be claimed for the escharotic plan. By means of a free incision, the Surgeon may not only divide the capsule thoroughly, but damage the tumour itself, and permit of the finger being employed at the time to accomplish the separation of the cyst-wall to as great an extent as practicable. The usefulness of ergot, after a free opening has been made, and the certainty of its action in promoting the expulsion of the tumour, is a point on which all observers agree. Whether or not an attempt

* For an interesting example of this, see Mr. Grimsdale's paper in the *Liverpool Medico-Chirurgical Journal*, No. I. I do not know where to turn for the record of an instance of *spontaneous piecemeal* disintegration, such as occurs in the cases surgically treated. One such, however, happened in St. Bartholomew's about ten years ago, the patient being one of the ward-nurses, and its particulars were mentioned to me, in conversation, by Mr. Paget. The woman recovered; but Dr. West informed me that subsequently another tumour protruded, as a polypus, was removed by ligature, and that death from pyæmia followed.

should be made to accomplish the enucleation of the sloughing mass, by the hand, within a week or two of the commencement of the treatment, or whether it should rather be left to disintegrate and come away in fragments, is a point which the circumstances of the particular case must decide. Dr. Atlee's experience seems to be, that the tumour may be left to disintegrate, with very good confidence (provided it has been well exposed and freely cut into) that such result will ensue; and some facts which have fallen under the writer's observation lead him to give full credence to this *à priori* improbable statement. The vitality of many uterine fibroids appears to be very small indeed, and comparatively little interference will often suffice to insure their death; whilst the manner in which large tumours, when they have once become sloughy, will, as it were, melt away, is quite astonishing.

What events may be expected when fibrous tumours are not interfered with? The determination of the feasibility of the enucleation treatment does not rest solely on an accurate estimate of the amount of risk which inevitably attends it. We must consider the other alternatives which are offered us. And here, in truth, is by far the greatest difficulty of the question. If these tumours were always fatal within a short space of time, no one would hesitate to recommend a procedure that offers a fair chance of a complete cure in a proportion of about two-thirds. But we know, on the other hand, that they are by no means of infrequent occurrence, and often cause to their possessors exceedingly little inconvenience. In cases, too, in which at one period, and that often a protracted one, repeated and exhausting hæmorrhages have been induced, we know that not infrequently the tumour will either alter its position, diminish in size, or undergo such modification in its relations that the troublesome symptoms may cease to occur, and the patient be restored to health. On this point we will quote only the confirmatory testimony of Lisfranc, which is the more valuable because it comes from an ultra-partisan of the operation. After speaking of temporary abatements of symptoms, that Surgeon writes: "Il est des personnes plus heureuses; après avoir éprouvé pendant quelques années des douleurs violentes, des pesanteurs fort incommodes, des pertes très-abondantes, beaucoup de troubles dans les fonctions digestives, &c., elles voient ces phénomènes morbides se dissiper; l'embonpoint renaît et même quelquefois la fraîcheur: il existe seulement un peu de fleurs blanches, une légère pesanteur et quelques petites douleurs dans les reins; j'en soigne plusieurs qui, portant des matrices énormes et fortement bosselées, fournissent depuis dix ou douze ans leur carrière avec les faibles inconvénients que j'ai indiqués; elles semblent promettre de la poursuivre longtemps et peut-être même, à l'aide des moyens hygiéniques et de quelques soins thérapeutiques, comme si l'utérus était à l'état sain." *Clin. Chir. de la Pitié*, vol. iii. p. 16. Researches in the pathological

theatres show us what these changes are, the effects of which we have noticed in the sick-room. Uterine tumours are often found contracted, and to a large extent calcified; or they may be lodged in the outer part of the uterus, or even pedunculated into the peritoneal cavity. We might also mention, under the possible events which may obviate the necessity of an operation, that spontaneous enucleation may occur; but, as we have seen above that the risks attending this process are probably as great as when the Surgeon interferes, it need not claim much attention. Thus, then, there are probably but very few cases in which the conscientious Surgeon could say to his patient that there was no chance of recovery without an operation. Still, however, that numerous deaths from these tumours do occur is undoubted;* and in certain cases the amount of reasonable hope is, it will generally be admitted, very small indeed. While, therefore, the indiscriminate adoption of these operations would be exceedingly unwise and wrong, yet we cannot but think that the reverse is the case under conditions of urgency. It happens very fortunately that tumours which cause serious symptoms are usually those most easily accessible. The proximity of the tumour to the mucous membrane of the uterus or vagina, but especially to that of the uterus, appears to be the main determining cause of hæmorrhage, and just in proportion as the mass bulges inwards is of course its suitability for enucleation. Tumours of very large size have, on the contrary, usually risen well out of the pelvis, and the symptoms attending them are often comparatively insignificant.

Conclusions. I state the following as conclusions, not in any dogmatic or positive sense of the term; they are the impressions arrived at after much careful study of the subject, but further experience may very likely modify some of them:

1. That surgical interference with interstitial fibrous tumours of the uterus is always attended with very considerable risk, and ought not to be practised except under circumstances of urgency, or when the position of the growth is peculiarly tempting.

2. That when the tumour is not of very large size, and is already partially extruded, the operation is rendered comparatively devoid of danger, and ought to be performed at once.

* An instructive and warning case of death from a fibrous tumour, which was in an advanced process of spontaneous extrusion, is given by Mr. Grimsdale in the paper already referred to. The tumour was found after death to have been well suited for removal by operation. Many such cases might doubtless be collected. I refer to Mr. Grimsdale's paper with much pleasure, on account of the ability and candour which characterise it. Those who contemplate the performance of operations of this kind will do well to refer to it, as also to the detailed descriptions which have been given by French Surgeons.

3. That when the tumour is as yet wholly embedded, and even when of large size, the enucleation treatment is yet warrantable, if the patient's life be threatened by hæmorrhage.

4. That primary enucleation, where at all easily practicable, is much preferable to the secondary method.

5. That where the tumour is very large, or where found after the incisions to be firmly united to its capsule, the secondary plan should be preferred.

6. That whichever plan it is intended to adopt, the first incision should, excepting under unusual circumstances, be made from within the cavity of the cervix, and should be as free as possible.

7. That the danger of hæmorrhage from this incision is very slight indeed.

8. That as much should be done as practicable at the first operation in freeing the tumour from its cyst. Thus if the adhesions be found more loose than had been expected, a primary enucleation may be completed where the slower plan had been proposed.

9. That the after-treatment, in cases of primary enucleation, should consist in warding off the shock by opiates, in sustaining the strength, and in the free use of stimuli and nutritious diet.

10. That in cases of secondary enucleation the ergot of rye should be administered, so as to keep up vigorous uterine action; and that the greatest attention should be paid to sustaining the patient's strength, and to the removal of discharge and shreds of slough, as fast as formed.

11. That in cases of great exhaustion and threatened pelvic inflammation the internal use of turpentine is of great value.

12. That in cases of secondary enucleation the Surgeon need not be anxious about the removal of the tumour *en masse*, but may confidently expect that, if it have taken on a sloughy state in its lower part, the death and piecemeal disintegration of the whole will follow.

13. That the "recurrent fibroid" tumours slough away yet more readily after interference than the true fibrous ones, although liable to return after a short interval.

14. That after a successful enucleation-procedure complete, though gradual, restoration to good health may be expected.

CANCER OF THE UTERUS IN REFERENCE TO SURGICAL TREATMENT.

Malignant disease of the uterus rarely presents itself to our notice in a stage permitting of surgical cure. Including in that term the

so-called cauliflower excrescence, the epithelial cancer, and the medullary cancer, the remark still applies to all, that they have usually advanced too widely when the Surgeon is first consulted, to allow of the satisfactory employment either of the knife or caustics.* In a vast majority of cases, all these forms of morbid growth begin at or very near to the os uteri; and if discovered early, would probably admit of removal, in many instances, with benefit more or less lasting. In all, however, the ulceration extends rapidly, and the patient does not submit to an examination until already the vaginal tissues have become involved, or the cervix has been deeply attacked. If the disease have thus widely extended, if it have left the lips of the uterus laterally, or if it have passed upwards and induced thickening of adjacent structures, then the operation of excision is attended by great danger, and affords but little chance of benefit. Hence it follows that suitable cases for operation are very rare.

It is not by any means an easy matter in many cases to make a confident differential diagnosis between a simple or venereal ulceration of the os uteri and one of a malignant nature in an early stage. The tendency of the latter to bleed, its warty and thickened edges, and foetid discharge, are the chief symptoms on which to rely. The Surgeon must notice especially whether there be any tendency to new growth, and, if practicable, a small portion of the edge should be removed for microscopic examination. Pain, if severe, is a very suspicious sign. That old syphilitic ulcers may occasionally assume cancerous action, there is good reason for believing. If doubt be felt, it should, if possible, be removed at once, either by consultation with others, or by resort to the microscope; for if the disease be in a stage permitting of removal, it should on no account be allowed further time for extension.

With regard to the diagnosis from each other of the different varieties of malignant disease met with in this locality, no practical benefit can be got from its detailed consideration here. With respect to them all, the question of surgical importance is more as to extent than kind. All, if limited to the lips of the uterus, and the latter organ be unenlarged and quite movable, should be either removed by operation or destroyed by caustics. If neither these procedures are appropriate, the only resource left is palliative treatment—the mitigation of pain; the restraining of hæmor-

* "Though for the past twelve years I have been constantly looking out for cases suitable for it, but one instance has come under my observation, in which my surgical colleagues have considered it justifiable, and two or three more in which, in my opinion, it might have been attempted." Dr. West's *Lectures*, p. 413.

rhages, and the lessening of discharge and fœtor. Opium, rest in the recumbent posture, and the use of detergent injections (arsenic, Condyl's fluid, chloride of zinc, and the like) are the means by which these indications are to be attained. The prognosis of malignant disease of the uterus, despite all that can be done by art to diminish the sufferings which lead on to the inevitable result, is most gloomy. The fact that a most painful and protracted death is the other alternative ought certainly to be allowed its due weight in inciting us to energy in the treatment of any cases which come under observation in an early stage, and may even justify resort to measures not by any means free from immediate risk.

I shall probably be excused for not entering here into any examination of the operation for extirpation of the whole uterus when affected by cancer. That, excepting in very rare instances of complete procidentia, it is not justifiable, is admitted by all. Dr. West, who has carefully collected the statistics concerning it, informs us that of a total "of 25 cases, 22 terminated fatally in consequence of the operation," and but 3 recovered. Of the three latter, "two months, four months, and one year were the periods during which the patients respectively survived."

Excision of cancerous ulcers affecting the lips of the uterus, or amputation through its cervix, is an operation of a very different character, and in well-selected cases not attended by any large amount of risk. Its introduction dates from the earliest years of the present century, when it was largely employed by Osiander of Göttingen, and subsequently by Lisfranc of Paris. Unfortunately, for reasons which we need not state, the large statistics brought forward by the latter Surgeon are utterly without value. In this country it has not been very largely adopted, although many Surgeons have performed it in isolated cases. Professor Simpson has probably had the largest experience of any British Surgeon respecting it.

Mode of performance. The patient should be placed in the lithotomy position, and the thighs well separated. The vagina being opened by the duck-billed spatula,—or, if requisite, by a bivalve speculum,—the cervix should be securely seized by long-toothed forceps or Museux hooks, and steadily but gently dragged downwards. At this stage it is a good precaution to transfix it laterally, above where it is intended to cut, by a needle armed with a wire ligature, the latter to be retained. The uterus having been brought as low as possible, the incisions are to be commenced below, at a suitable distance from the diseased structures, and carried from behind inwards and upwards; then a similar incision is made in front, and carried inwards and backwards so as to cut out a conical portion. In this incision either scissors or knife may be employed; if the latter, it should have a rounded point. After the section, by means of the wire previously inserted, the stump may be still held in view, both to permit of examination as to whether the disease has been completely removed, and of the application of escharotics, should the hæmorrhage make them desirable. The advantage of beginning at the lowest part is, that the blood does not conceal the surface where the next incisions are to be made. It is one of those operations in which the plan of constant irrigation during its performance might perhaps be adopted with advantage. The actual cautery and the perchloride of iron ought to be at hand, in case their application may be required. As hæmorrhage may chance to recur some hours afterwards, it is desirable to retain hold of the stump by leaving the wire in, or the latter may be made use of to tie a compress of lint over the bleeding surface.

With the precautions above described the operation of excision by cutting

instruments is probably safer and preferable every way to that by the *écraseur*. With the latter instrument the Surgeon is not able to adapt his line of incision accurately; the chain must pass horizontally across the entire cervix, and, in order to be sufficiently above the disease, at one part it may be needful to take much more than is necessary at the opposite side. This would be of minor importance if it did not involve more or less risk of including a portion of the peritoneal pouches, which have been drawn down by the back and front parts of the cervix.* It is impracticable with the *écraseur* to remove a conical portion, as advised above; and lastly, although this instrument obviates to a great extent the danger from hæmorrhage, it probably increases those from peritonitis and pyæmia. It is for cases of long cervix that the *écraseur* is specially adapted, and precisely in the same is direct excision easy and safe.†

After the amputation of the cervix uteri, whether by scissors or *écraseur*, the patient should be carefully and unremittingly watched for twenty-four hours. In addition to the risk that bleeding may occur, it is possible that a peculiar form of collapse (abdominal collapse of Dr. Barnes) may supervene. Dr. Simpson records two such cases, one of which proved immediately fatal, there having been no hæmorrhage or other cause adequate to explain it.

For reasons already hinted at, it is almost impossible to obtain any trustworthy data, either as to the immediate risks of the operation or the average duration of life in successful cases after it. Dr. Simpson records in detail one case in which he excised a large epithelial cancer (cauliflower excrescence), and the woman, at the date of his lecture (eighteen years after the operation), was still in good health, having borne several children in the interval. He seems to be, on the whole, very favourably impressed as to the value of the operation; but he abstains from furnishing any numerical data as to the results he has obtained.‡ With the exception of two or three cases in Guy's Hospital, the operation has not, I believe, been performed of late years in any of our larger London hospitals. The Guy's cases were, I believe, all successful, but productive only of temporary benefit.

If the case be one in which the Surgeon has any choice as to performance of excision, he will probably do well to prefer it to the use of escharotics. There are certain cases, however, in which the disease extends too deeply for a safe excision, where it may yet be fair to employ the former. The best for the purpose is probably the dried sulphate of zinc, as advised by Professor Simpson. It may be applied either in powder, by aid of a speculum, or made up into a pessary by means of ointment. Some carbonate of soda, in the form of a pessary, should be introduced into the vagina, to neutralise the zinc in case it should run. The potassa fusa is not manageable; but the chloride of zinc may, with care, be conveniently used. The actual cautery is, however, perhaps as efficient, as free from risk, and as little painful as any, especially when heated by the aid of galvanism. In many cases in which escharotics have not effected a cure, the patient has yet been fully compensated for the pain incurred by the temporary alleviation of symptoms which resulted.

* This risk is not imaginary. I am acquainted with a case in which a considerable portion of the peritoneum was thus removed. Others are also on record. See Dr. Simpson's Lectures in the *Medical Times and Gazette*, vol. xviii. p. 105, and Dr. West, loc. cit. p. 416.

† If the *écraseur* be used, an instrument with a curved end will be found more convenient than a straight one. A strand of twisted wire, as recommended by Simpson, will be better than a chain.

‡ The following extracts from his lecture are of much interest: "I never saw a case which proved fatal by bleeding, or even one where hæmorrhage occurred in any alarming degree." "Let me lastly observe, that some patients, but not very many, have died of peritonitis, or that form of surgical fever," &c.

MALIGNANT DISEASE OF THE EXTERNAL GENITALS.

The only forms of malignant disease by which the external genitals of the female are attacked are epithelial cancer and rodent ulcer. With the epithelial disease, there may in some cases be a certain amount of melanotic growth interspersed, or the disease may even begin in a mole, and be chiefly of the latter character. In females of middle age epithelial cancer of the labia, or adjacent parts, is by no means infrequent. The disease presents the same characters as in other parts. An irregular, undermined indurated edge, an unhealthy gray surface, and a tendency to the production of warty granulations, are its chief features. It is a most formidable disease. Absorption from these parts is usually very rapid: the glands in the groin become contaminated with startling rapidity; and the Surgeon's function is then for the most part restricted to attempts at alleviation. I have witnessed about a dozen operations for epithelial cancer on these parts, and have myself operated in three cases. In all the cases, with the subsequent history of which I am acquainted, the result has been a speedy recurrence. In two of my own it was needful to remove also diseased glands from the groin. Epithelial cancer does not affect the female genitals nearly so frequently as some other parts. In the *Medical Times and Gazette*, during 1860, I collected data respecting a large number of cases of this form of cancer. The report may be considered as statistical; and it shows 127 cases in which the lip was attacked, 19 the tongue, 15 the cheeks, and 36 the scrotum, to 14 in which the female genitals were its site. These, it must be remembered, were all cases in which operations were performed.

Like epithelial cancer of the penis, scrotum, &c. in the male, it is chiefly met with in middle-aged or elderly persons; but may occasionally be found in younger persons.

Although, as above stated, it is extremely prone to recur after excision, yet, as we possess no other remedy, there can be no doubt that, wherever practicable, the diseased part should be freely removed, or destroyed by caustic. In most cases the knife is probably preferable. If the inguinal glands are at all enlarged, such as are so should be removed also. These operations are rarely dangerous to life, and usually the patient's sufferings are wholly relieved for the time; often a few months of enjoyable life are obtained before the disease recurs. Since, therefore, in almost all instances they give relief for a longer or shorter period, while there is always a chance that a cure may be obtained, it is without doubt the Surgeon's duty to give his patient the benefit offered whenever practicable. If the disease recur, a second period of health and freedom from suffering may be obtained by a second use of the knife. Whether the operation be a primary or a secondary one, it is impossible to exaggerate the importance of doing it early. It is in the early cases that the chance of a genuine cure is greatest.

Respecting the Rodent Ulcer, little need here be said. It is very rarely met with on the female genitals. I think I have seen one undoubted example of it. It is distinguished from epithelial cancer by the absence of warty growth, by its slow progress, and by its never causing the lymphatic glands to enlarge. It should always be excised where practicable.

NON-MALIGNANT DISEASES OF THE EXTERNAL GENITALS.

The diseases of an innocent nature to which the external genitals of the female are liable will chiefly find place in connexion with other subjects. Thus, the induration and enlargement of the labia, clitoris, &c. are most frequently consequent on venereal affections. It may be convenient, however, to remark here, respecting the removal of these enlargements, that they may for the most part be undertaken with perfect safety. Hypertrophies of the labia commence usually in inflammatory œdema, produced by the irritation of gonorrhœal discharge, or of mucous tubercles; but when they have advanced to a certain extent, they tend to increase, in consequence of the mechanical impediments to a normal state of circulation presented by their pendent position, and without any reference to their original cause. It is therefore very desirable that they should be removed early. When very large, the risk of very profuse hæmorrhage is considerable. The bleeding is usually from a multitude of small vessels, not from any single one of considerable size. A good precaution against hæmorrhage is to transfix the base of the pendulous mass by means of harelip-pins before using the knife. Over these pins twisted ligatures may be applied, so as tightly to compress the divided structures, and arrest all bleeding. Of course, all vessels that can be tied separately should be secured previously to the application of the twisted sutures. On several occasions I have found the latter the only means by which the continued draining from very small vessels could be stopped.

These tumours consist only of hypertrophied cutaneous structures, and may be developed to a very large size indeed, if not removed in anticipation. They may involve one or both labia, the clitoris, or any part of the immediately adjacent integument. It is sometimes needful to bear in mind that their subjects have often also suffered from constitutional syphilis, since, in the after-treatment of the wound, specific remedies may become necessary.

Cystic tumours may be met with occasionally in the subcutaneous tissues of the female genitals. The most common are those formed in connexion with the Cowperian glands. They are to be found about an inch or an inch and a half within the vulva, and placed a little below the middle of one or other side of the vagina.

They are usually somewhat movable, and non-adherent to the mucous membrane; often very tender to the touch; and rarely larger than a chestnut. When opened, a glairy mucus escapes, often of foetid odour. Their mucous contents may be mixed in greater or less degree with inflammatory products; and sometimes acute inflammation has occurred, and dirty grumous pus, of most foetid smell, is the product. For all these conditions the simple measure of treatment is to lay them freely open, and to introduce lint, to prevent permature closure of the orifice. They are more common in young women than in those of more advanced age, and are not unfrequently met with soon after marriage.

In rare instances cystic tumours of much larger size than those developed from inflammation of Cowper's glands occur beneath the labia. These sometimes possess a smooth lining-membrane, which it is desirable to dissect cleanly out, in order to prevent refilling. Their contents are usually glairy, indicating that the starting point was from a follicle or mucous gland. There is almost always the history of long duration. An entire absence of inflammatory irritation has usually been the reason for their being allowed to attain to an inconvenient size before surgical advice has been sought. In undertaking the removal of these cysts, the Surgeon must always be prepared for free hæmorrhage, owing to the highly vascular endowments of the parts.

SURGICAL MEASURES IN EXTRA-UTERINE PREGNANCY.

A large majority of extra-uterine pregnancies end in death from internal hæmorrhage within a few months from the date of conception. In some instances the foetus perishes at an early period without rupture of its investments, and in these without causing any ill consequences at the time of its death; it may subsequently remain, for indefinite periods, as an encapsuled mass within the maternal organism. In a smaller group of cases neither of these events happens; but the life and growth of the foetus are prolonged to the full period of gestation, at or about which time, however, it inevitably dies. It is these latter cases alone which are likely to become of interest to the practical Surgeon.

In a case in which an extra-uterine foetus has died at the full period of gestation, and remains lodged in its mother's abdomen, several events may ensue. The foetus may, in the first place, remain without causing irritation, may gradually diminish in bulk, and having been converted into a mass of adipocere, be carried without material inconvenience to the end of a long life. Many

instances are on record in which this has been the course of events, and there is abundant proof that a woman may, even without detriment, pass through repeated pregnancies with an encysted extra-uterine child still lodged within her. The second possible course is, that the foetus may set up irritation, induce suppuration, and cause ulceration, either through the abdominal wall, or into the vagina or rectum; and that thus a process of natural expulsion may be accomplished. A third event, which, like both the preceding, is exemplified in many recorded cases, is that the foetus may cause such an amount of constitutional disturbance as will be fatal to the mother before there has been time for any process of expulsion to take place.

The questions, therefore, on which a Surgeon, who is called upon to decide as to the treatment to be adopted in a case of this kind, will require information, are:*

1st. What is the probability as to the foetus remaining in a quiescent state, should the case be left to nature?

2d. What is the amount of risk that extreme, or even fatal, constitutional irritation may be set up?

3d. If the foetus set up inflammation, and a process of spontaneous expulsion be commenced, what is the prospect as to the mother's surviving it, and what may be expected to be the amount of suffering through which she will probably have to pass?

4th. Should the Surgeon decide to remove the foetus by an immediate operation, what is the degree of risk attending such a procedure?

5th. Supposing the case to be for the present left to itself, will there occur, at any subsequent time, a suitable occasion for the removal of the foetus after symptoms of irritation have commenced?

To enable us to reply to the above questions, a very considerable array of cases may be found on record, and they are of a character in respect to which the evidence afforded by well-judged statistics may become exceedingly valuable. It is not compatible with the space permitted by the present work to cite the cases themselves; and I am obliged, therefore, to refer the reader who may wish to investigate them more minutely, either to the excellent monograph of Dr. Campbell, or to a series of reports compiled by myself (in large measure from Dr. Campbell's book), and published in the *Medical Times and Gazette* for July and August 1860. In the reports in question, I have carefully collected all the cases I could find published, amounting in total to

* I have said nothing in respect to the diagnosis, since it is usually not difficult. It may be well to insist on the necessity for great caution before resorting to any operative measures. This caution is especially needful in regard to the subjective evidence furnished by the patient. In one case, in which Dieffenbach was the operator, and the measure was resorted to under the sanction of Dr. Heim, no foetus was found, and the abdomen was again closed without removing any thing. Fortunately in this case the woman recovered. At page 58 of the *Medical Times and Gazette* for July 1860 is the narrative of a case in which the history might very easily have misled. The Surgeon must rely almost solely on the evidence afforded by manipulation, &c. of the supposed tumour.

no fewer than one hundred and two. These may be conveniently grouped under the following heads :

Group A. Cases in which the fœtus was retained in a quiescent state in the mother's abdomen to the end of her life. In this group we have twenty-one cases. In three or four instances living children had subsequently been born. The shortest period of the mother's life after the death of the fœtus was four years, the longest fifty-six years. A very much larger number of cases are on record, in which the remains of extra-uterine conceptions were retained for long periods without inconvenience. In most of these, however, there is reason to believe that the fœtus had not nearly attained its full growth, and they have therefore been excluded.

Group B. Cases in which, without any operation, the fœtus set up irritation, and caused the mother's death. This group is a very important one, since it contains those in which the natural processes were neither interfered with nor assisted, and in which they proved incompetent to the preservation of the mother's life. In not a few of them it is probable that surgical interference at the proper juncture would have saved the patient. In this class we have thirteen cases. In some, death occurred either during the symptoms of false labour, which usually occur at the time the fœtus dies, and last a few days or a week, or within a short period afterwards. In others the mother lived for a few months after the death of the fœtus, and in one for as long as two years and seven months. In none of the cases counted in this group had any abscess given way externally; but in several inflammation of the sac had occurred, which would no doubt, had the patient lived longer, have terminated in ulceration, and an attempt at spontaneous expulsion. The lesson of these thirteen cases seems strongly in favour of interference.

Group C. Cases in which ulceration through the abdominal wall took place, followed by escape of the fœtus. We have in this twenty-nine cases, in fourteen of which no surgical interference took place; whilst in fifteen, subsequent to the abscess having given way, an incision was practised, and the foetal remains extracted by the hand. It will be convenient to call this latter procedure *secondary* abdominal section, to distinguish it from *primary* abdominal section, by which we denote an operation performed prior to the occurrence of abscess. Of the fourteen cases in which nature did all, eleven recovered, and two died; the result in one not being known. Of the fifteen in which secondary abdominal section was performed, in one the result is not known, and of the others all but one recovered. The cases in the next group differ only from these in regard to the position in which the abscess gave way.

Group D. Cases in which ulceration into the vagina or rectum occurred, followed by expulsion of foetal remains. In several of these, more or less of surgical assistance was afforded in the extraction of bones, &c., as they were protruded from the cyst into the cavity involved. The group comprises twenty-three cases, of which only three ended fatally.

There now remain for consideration only the last and very important group of cases, in which the Surgeon interfered early, abdominal section being performed before abscess had occurred. In some of these the operation was performed during inflammation of the cyst, and when the patient's constitutional symptoms required that something should be done for her relief; in others, it was adopted when all was for the present quiet, and with the object of ridding the patient of a burden, or of preventing possible mischief in future.

Group E. Cases in which primary abdominal section was performed. In this group we find sixteen cases; out of which six resulted in recovery, and nine in death.

Keeping our attention strictly confined to the question as to the propriety of surgical treatment in these cases, it will be seen that the facts just adduced afford us most valuable guidance. The facts in favour of *secondary* abdominal section are conclusive. No one can doubt that in cases in which processes of suppuration and ulceration have already been set up, it is the Surgeon's province to assist in the removal of the decomposing body. The

chief point in debate is, therefore, in respect to those cases in which as yet no symptoms have been induced. Let us suppose a woman in perfect health with an extra-uterine foetus of full growth, and dead, retained in her abdomen. She has probably passed the date at which labour was expected by several months, and is quite free from all uterine disturbance; her menstruation being again regularly established. Ought the Surgeon, in such a case, to perform *primary* abdominal section; or ought he to advise the patient to let present well alone, and not submit to operative interference until it should become needful? On the one hand is the fact that a large number of cases similar to our supposed one have been followed by no ill consequences whatever, and that their subjects have lived to old age, in some instances becoming the mothers of living children; on the other hand, we have seen that, in a considerable majority of cases, the retained foetus does sooner or later set up irritation, and, in not a few, of such a severe character as to cause the death of the mother. If no opportunity for surgical interference were likely to occur again, there might be valid reason for urging the immediate operation. But the fact is, as I have shown, that while primary abdominal sections are very fatal, those performed subsequent to spontaneous ulceration are followed by a large proportion of recoveries. The difference between the two operations is very great indeed. In the one, in all probability, a healthy peritoneal sac is laid open; whilst in the other, adhesions having formed, the incision amounts to little more than opening a large abscess. After the one, the decomposing débris of the placenta, the foetid pus, &c., will have access to the peritoneal sac; whilst in the other they are wholly shut off by adhesions. In the one, a healthy woman is subjected to all the dangers of a sudden and most severe operation, for which her system has been in nowise prepared; in the other, a source of irritation is removed from the organism at the very time when it is becoming felt to a degree almost incompatible with the continuance of life. Whoever shall carefully examine the cases to which I have referred will, I think, come to the conclusion that the longer the interval allowed to elapse between the death of the foetus and the operation for its removal, the less the danger of the latter. Dr. Campbell regards the operation as not advisable until after "the system of the parent has been restored to its unimpregnated condition, and nature has evinced a disposition to remove the extraneous mass." The difference in risk at different times has, however, in all probability much more to do with the state of the peritoneal sac as regards adhesions than with any other condition. The longer the operation is deferred, and the more prolonged the inflammation, the greater is the probability that efficient adhesions will have formed.

As regards the operation itself, little need be said. The tumour should be opened over its most prominent part, and sufficiently freely to allow of the introduction of the hand. Unless the placenta be found detached, it ought not to be removed, but left to come away afterwards. The attempt to detach it might very possibly tear through the cyst, and open into the peritoneal cavity. If no adhesions between the cyst and the parietes be found, the opening in the former should be brought well forward into the wound, and there secured by sutures. The after-treatment should be conducted on general principles.

OPERATIONS FOR RUPTURE OF THE PERINEUM AND ITS CONSEQUENCES.

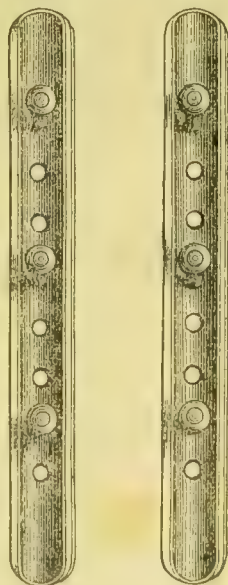
Rupture of the perineum occurring during the passage of the foetal head may vary very greatly in its extent. If it involve only a limited extent of the anterior edge, it is of little consequence, and may be disregarded. If, however, it extend backwards through

almost the entire length of the structure, there will be great risk that if nothing be done the patient will hereafter suffer from prolapsus of one or other of the pelvic viscera. In a still more severe class of cases, the sphincter of the bowel is also torn through, with the result of incontinence of fæces. In all cases except those first mentioned, in which the laceration is trivial, it is very desirable that the rent should be closed. Should opportunity occur immediately after delivery, it cannot be done too early. The edges of the tear should be well cleansed, and secured firmly in apposition by deep sutures in the manner about to be described. It is quite possible that the bruised condition of the parts, the presence of lochial discharge, and the state of the patient's health, may interfere with union; but even should they altogether prevent it, nothing will have been lost by the attempt.

Should no operation have been performed immediately after the accident, or should it have failed to secure union, the patient will probably come under care subsequently, suffering either from prolapsus or inability to retain her fæces, or from both. Whether the sphincter ani have been torn or not, signifies but little as regards the operation to be performed. It is remarkable that it is as easy to procure union in the more severe as in the slighter cases, and the mode of operating is very similar in both. With regard to the relief of the two classes of symptoms, however, it is widely different. If the sphincter ani have been torn through, the patient may be safely promised that an operation for the restoration of the perineum will be effectual in giving her full control over the lower bowel; but it is impossible to speak so confidently as regards the lesser evil of prolapsus. With respect to the degree of advantage to be expected as to the prolapse, the reports of those who have tried these operations vary considerably. Those who appear to have examined the matter most candidly confess that in not a few cases considerable disappointment followed; and that although benefited for a time, the prolapse subsequently returned. We can have little difficulty in understanding this, if we bear in mind that the severest forms of prolapsus, whether of uterus, rectum, or bladder, are quite compatible with perfect integrity of the perineum. Other causes besides want of support below usually conduce to the descent of the viscera into the vulva. Still there can be no doubt whatever in the minds of those who have seen much of these cases that loss of the perineum favours prolapse, and that its restoration does much to obviate it. With regard to the degree of benefit obtained, much will depend upon the mode of operating. If, as in several cases

on record, the operator contents himself with simply denuding a narrow strip on each side the vulva, and uniting the parts across, a thin perineum, consisting of little more than integument, will be the result; and the most that can be expected will be, that what was complete prolapsus may subsequently not amount to more than procidentia. If, on the other hand, the denudation be carried high up into the vagina, and the parts carefully united very deeply, the lower two inches of the canal may be very greatly narrowed, and a very effectual impediment to the descent of the viscera afforded. Although operations with this object have been performed in England during the last few years by many Surgeons, and with considerable frequency, yet but few data are on record by which to estimate its ultimate benefits. I may therefore, perhaps, be excused for referring to my own individual and but limited experience. Including three cases in which the sphincter ani was also torn through, my operations for restoration of the perineum, in order to obviate prolapse, have been ten in number. In none did any untoward results occur; but in one no union was obtained. In two or three, to my knowledge, the patients suffered from procidentia more or less during subsequent years. In three others I lost sight of the patients within a few months of the operation, there having been no relapse whilst they remained under observation. In three I can speak confidently as to the permanency of the relief afforded, since I had opportunities of examining the patients several years afterwards. In one instance the patient, an elderly woman, who before the operation suffered from complete prolapsus in a most distressing form, the uterus being swollen and deeply ulcerated, received most signal benefit. I examined her repeatedly during the two years following, and always found the uterus high up in the vagina. She lived six years afterwards; and I was assured by her daughter that up to the time of her death she had remained quite free from her old malady.

The operation for making a new perineum is conducted on the same plan whether the sphincter ani be torn through or not. The cicatrised edges of the laceration are to be freely denuded and the parts united by deep quill-sutures. There is not usually any more difficulty in closing a complete rent than there is in one in which the sphincter has escaped. The sutures may be tied over a piece of quill, a rod of glass, a piece of bougie, or, what I prefer most, a perforated metal bar. I have used those figured in the woodcut in several cases, and



found them exceedingly convenient. The wires are brought through the holes and then twisted round the little pegs. This allows of any single wire which may appear to be either not tight enough, or too tight, being readjusted with great ease.

During the operation the patient should be under the influence of chloroform and in the lithotomy position. The vagina should be well opened by means of the duck-billed speculum, and a plentiful supply of ice should be at hand to arrest the bleeding. It is desirable to denude extensively, both as regards the length and the thickness of the new perineum. Very much, as to the degree of relief to the prolapsus, will depend upon whether a good thick cushion is obtained or only a thin cutaneous one. It is desirable also to narrow the vagina for some distance. These important ends are best secured by dissecting up the mucous membrane of the vagina, posteriorly and laterally, for a considerable length upwards. Immediately in front of the rectum the denudation should extend an inch and a half upwards, and from this point it may slant laterally on each side, downwards and forwards, to the point selected as the front edge of the new structure. The dissection should begin from below. Instead of cutting away the flap of mucous membrane, I much prefer to adopt a plan somewhat similar to that of Fricke. The mucous membrane is turned upwards into the vagina and the deep sutures are passed, the one nearest to the rectum being introduced to the full depth of the denuded tract, *i.e.* an inch and a half from the orifice. The other sutures will pass to less depths, the most anterior one being the shallowest. The flap of mucous membrane is now freely trimmed at its sides, and is united by wire sutures to the anterior edges of the new perineum. It thus slopes forward, covering over the deep surface of the newly united parts, and extending their whole length. This flap is nourished by its attachment above to the vagina, and, according to my experience, there is no risk of its sloughing. I believe that it materially favours union by preventing vaginal discharges from gravitating into the wound; and it also greatly thickens and strengthens the new perineum. Of course, when the rectum is torn high up, a central flap cannot be obtained; but I should still, in these cases, incline to save as much as possible of the lateral ones. The parts should not be closed until the bleeding, which is often rather free, has a good deal diminished. A recurrence of hæmorrhage within a few hours of the operation is not very unusual; and, with a view to its prevention, it is well to leave a fragment of ice in the vagina, and to apply an ice-bladder externally. Some operators have insisted strongly on the importance of freely dividing the sphincter ani; and in cases in which the laceration extends high into the bowel, this measure is undoubtedly important. In cases in which the sphincter has not been torn, it is certainly unnecessary to divide it; and even in some in which it has been so, excellent results may be obtained without.

In the after-treatment the bladder should be kept empty and the bowels confined. The sutures should not be removed until the sixth or seventh day, and, however favourable the result, the patient should be made to keep her bed for at least three weeks.

The recumbent posture made necessary by the operation is, no doubt, an important part in the cure of the prolapsus for which the operation is often performed. It allows time for a swollen and, perhaps, ulcerated uterus to diminish in bulk and weight, and for its relaxed ligaments to strengthen.

ORGANIC DISEASES OF THE OVARY.

When we consider the peculiar function of the ovary, and the irregular demands which are made upon its activity, it is not surprising that it should frequently become the seat of disease. Re-

stricting our attention in this essay to its organic affections only, we may classify these in two groups—the solid and cystic growths.

The *solid growths* met with in the ovary are, first, fibroid tumours, and second, malignant tumours. The fibrous tumours are decidedly rare. They may in some instances attain very considerable size, and may even approach that of a pregnant uterus; more usually they are much smaller. Their substance is made up of dense fibrous tissue, which replaces the stroma of the organ, and by which the latter is at length wholly substituted. During life it would be difficult to diagnose with any certainty between a fibroid tumour of the ovary and a similar growth from the uterus (if detached and pedunculated); but as the rule of treatment is the same for both, but little practical importance attaches to the question. In both it is desirable to give a fair trial to the bromide or iodide of potassium, or to some natural water holding haloid salts in solution (Kreuznach, &c.). These salts are to be recommended, not so much in the hope of inducing any absorption of the tumour, as of repressing its vitality and arresting its further growth. Solid tumours occupying the abdomen, whether originating from the ovary or the uterus, and whether believed to be innocent or malignant, should not be interfered with surgically. If innocent, they rarely cause death, and at a certain period of life almost always begin to shrink; whilst any attempt to remove them by abdominal section is attended by great danger.* If malignant (*i.e.* medullary), the reasons against their removal, or rather against the attempt at it, are manifold and apparent. The form of cancer (very doubtfully such) most frequent in the ovary is that known as alveolar, or colloid, and the tumour thus constituted is cystic rather than solid. In rare instances, however, medullary cancer occurs as a primary disease in the ovary, and a very large tumour may be thus developed.

Cysts in the broad ligament. These very rarely attain any large size. They are not unfrequently met with in infants, but are rare in adults, and are consequent on cystic dilatation of the tubes of the Wolffian body. They have little or no surgical interest,

* In these remarks it is intended to include only those tumours which have passed upwards into the abdominal cavity and become pedunculated. Uterine fibroids still occupying the walls of the uterus are treated of elsewhere (see p. 500). It must be always remembered that the dangers of abdominal section for solid tumours far exceed those of ovariectomy. As the tumour cannot be diminished by tapping, the incision must be very free, whilst the peduncle, if it exist, is certain to be short, thick, and very vascular.

since they scarcely ever attain a size sufficient to call for treatment, or even to be discovered during the life of their possessor.*

Cystic disease of the ovary. This disease may present itself in two forms, either as *simple* or *proliferous* cysts; but the two are very closely allied, and the former may at any time assume the characters of the latter. Again, we must note that the proliferous or compound cysts differ much amongst themselves in the degrees in which their peculiar endowment is developed. Some show but little tendency to reproduction, whilst others exhibit the utmost activity. There is good reason for believing that the simple cysts of the ovary are developed by the dropsical dilatation of Graafian vesicles. Not unfrequently more than one is formed in the same ovary; and at later stages the partitions between them may be broken down, and a single irregularly chambered cavity may result. Simple cysts may attain a very large size, but the compound ones, as a rule, exhibit greater activity of growth. The *compound* or *proliferous* ovarian cyst is by very far the most frequent form of ovarian dropsy, and is closely homologous to the cystic diseases of the breast and testis, allowance being made for the different structural peculiarities of these organs. It is probable that the morbid action usually commences in the stroma of the ovary, but it may in some instances originate in the Graafian vesicles. With regard to the contents of ovarian cysts, it may be stated to consist of an albuminous fluid of greater or less density. In simple cysts the fluid is usually thin, but in compound ones it varies from the consistence of a dilute solution of gum-arabic to that of stiff glue. In the latter it often varies very greatly in different cysts composing the same tumour. In colour it also presents great varieties, from a clear watery fluid to a dark tar-like one. It often contains sparkling scales of cholesterine in immense quantities. In rare instances ovarian cysts contain a sero-purulent fluid or even pus. This is more common in simple than in compound cysts, and usually is a consequence of inflammation after tapping. The term "alveolar or colloid cancer" has been applied to a not very infrequent variety of compound cyst of the ovary in which very numerous loculi exist,

* "The size of an egg, an apple, or an orange is the greatest magnitude to which these cysts have yet been proved to attain." Dr. West, op. cit. p. 485. The only exception to this remark with which I am acquainted is a case operated upon by Mr. Caesar Hawkins, in St. George's Hospital, many years ago. In this instance the cyst was a simple one, and as it was removed by ovariectomy, had of course attained a large size. It was Mr. Hawkins's clear opinion that the cyst had no structural connexion with the ovary, but was developed in the broad ligament. The preparation, and some notes regarding it, are to be found in St. George's Hospital Museum.

and the spaces are filled by a semi-solid tenacious substance resembling gum. This variety, however, not unfrequently complicates tumours in which many cysts contain fluid and resemble those of the common compound form. There is much reason to doubt whether the usual tendencies of true cancer are ever manifested by it. Again, we must note that compound ovarian cysts differ not only in respect to the density of the contents, but also in the thickness of the intervening solid substance. Müller has applied the designation of cysto-sarcoma to those in which the fibrous inter-cystic substance equals or exceeds in quantity the contained fluid. Here, again, however, all degrees may be observed in different tumours, and even in different parts of the same tumour, and we cannot therefore venture to separate abruptly ovarian cystic tumours into different classes. Good typical examples of all of them,—*a*, the simple, single cyst; *b*, the simple but multiple cyst; *c*, the proliferous or compound cyst; *d*, the proliferous or compound cyst with colloid contents; *e*, the proliferous with large sarcomatous formation,—may frequently be met with; but in a large majority of instances ovarian tumours share the characters of two or more of these varieties. The more active the proliferous tendency, the further the departure from simplicity of organisation, the more nearly does that tumour approach in its relations to malignancy. Whether, however, any form of ovarian tumour, excepting the fungoid (medullary), is truly cancerous in its tendencies, is a matter of much doubt, and practically all must be treated as if it were proved that they are not so.

There is yet another variety of ovarian cyst to be mentioned, that, namely, in which a structure resembling the cutaneous integument (both in structure and function) is formed. These, known as Dermoid Cysts, possess the power of producing in their lining membrane all the appendages of the skin,—hair, teeth, &c.,—and of secreting into their interior the ordinary excretions of that organ. Thus not unfrequently teeth, balls of hair, or large quantities of fat are found in them. That these structures are, in many instances, in no way connected with impregnation, and are also quite independent of any “included foetation,” is amply proved.

With regard to the relative frequency of the different forms of ovarian disease, Dr. West supplies us with the following data: of a total of 60 cases, 41 recorded by Scanzoni and 19 by himself, simple cysts occurred in 15, fat cysts in 1, compound cysts (with cysto-sarcomata) in 23, colloid or alveolar in 19, cancer with cyst-formation in 2.

It had been hastily assumed, from calculations based upon opinions formed during the life of the patient, and necessarily liable to error, that ovarian cysts more commonly affected the *right* organ than the *left*. Post-mortem examinations prove, however, that the two ovaries are equally liable to disease. Dr. West concludes, from the examination of 19 of his own cases, 15 of Dr. R. Lee's, and 41 of Scanzoni's, that in about one-third both organs are affected. A reasonable suspicion may, however, be entertained that this proportion is much higher than more extended data will show.

Ovarian disease may occur at any *age*, from infancy upwards. It is of tolerable frequency during the whole period of sexual activity, but most so during the latter half, *i.e.* from thirty to forty-five. It is very rare in childhood,* and decidedly infrequent after the complete cessation of the menstrual function. It is relatively more common in single than in married women, and of the latter a large number have either been sterile or have manifested but feeble fecundity. No trustworthy inference as to the probable nature of the tumour can be drawn from the age or sexual condition of the patient. Beyond the fact that it is often associated with sterility or a low rate of fecundity, nothing can be asserted as to the causes of ovarian disease. In a majority of cases it develops itself in those whose sexual functions, with this exception, have appeared to be in perfect health.

The *rate of growth* of ovarian tumours is subject to considerable variety. In the majority of cases, in from two to three years from the commencement, or at least from its first discovery, the tumour will have become large enough to fill the abdomen and produce inconvenience by pressure on the viscera. In many the rate of progress is much more rapid; in a few, and especially in the aged, it may be much slower. Beyond the stage described we are not able easily to ascertain the average natural progress of ovarian tumours, since in a great majority of instances one or other mode of treatment is adopted as soon as the dropsy becomes a serious inconvenience. Such facts as are on record, however, do not encourage the hope that in patients under forty ovarian disease, not interfered with, may frequently be protracted over many years. As soon as the abdomen is distended, the patient's health begins to fail, the process of assimilation is interfered with, exercise is prevented, the demands of the tumour are a drain upon the patient's strength,

* Kiwisch alludes to a specimen of cystic disease of the ovary from a child aged one year. I have myself seen a large ovarian tumour in a girl of twelve.

and she becomes not slowly thinner and more feeble; the tumour still grows, the lower limbs become œdematous from pressure on the veins, the thorax (both ribs and diaphragm) is displaced upwards and fixed, rendering respiration difficult and incomplete;* the patient ceases to be able to lie down, and, after a most painful illness, death at length puts a period to her sufferings. That the later stages of ovarian dropsy should be prolonged over months instead of weeks would be a matter of regret rather than congratulation. In addition to the ills above mentioned, intercurrent attacks of peritonitis are common in the course of ovarian dropsy, and not very unfrequently spontaneous inflammation of the interior of one of the cysts takes place. Either of these occurrences may very seriously reduce the health of the patient, and the latter may prove directly fatal.

Before proceeding to consider the different surgical measures by which relief may be afforded, we must refer to the possibility of *accidental or spontaneous cure*. It is probable that now and then an ovarian cyst may, without having ruptured, spontaneously cease to secrete and become greatly diminished in size. This termination has, I think, been illustrated in one case under my own care; but there can be no doubt that it is an exceedingly rare one. The rupture of the cyst, either by violence or by ulceration, into an adjacent viscus is much more frequent, and numerous cases are on record in which cures have been brought about in this manner. Notwithstanding an occasional cure so produced, however, the internal rupture of an ovarian cyst is scarcely an event to be desired. In not a few the death of the patient is the immediate consequence, whilst in others recovery only results after severe peritonitis and a dangerous illness. It is of course only in cases of single cysts that any permanently satisfactory result is to be hoped, and even in these the probability is great that after the rent has closed, re-secretion of the fluid will follow. If instead of rupture into the peritoneal sac, the tumour have ulcerated into the bowel or vagina, all the dangers incident to inflammation of the cyst-cavity will probably be encountered.

We may, then, safely allege that ovarian dropsy is, as regards any probable process of natural and spontaneous relief, an incurable disease. Further than this, we may safely add that, putting aside certain exceptional cases met with chiefly in aged patients, it is a

* See plates, by Dr. Bright, in *Guy's Hospital Reports*, vol. ix., or in Newdenham Society's reprint, p. 90, plate 33, and p. 122, plate 36.

disease which, within from one to three years of its commencement, may be expected greatly to incapacitate its subject for the ordinary enjoyments of life, and at the end of one or two years more to end fatally, after extreme and protracted suffering. In this statement of clinical fact we have the measure of the value of surgical methods of relief. To these latter the reader's attention is now asked.

We have the time-honoured plan by *repeated tappings*. Paracentesis can be ranked only as a means of temporary relief, not as affording any probability of cure. On the contrary, there are reasons for thinking it probable that those cases in which it is practised end earlier than those in which it is refused. The operation itself is by no means devoid of danger. Attacks of fatal peritonitis after it are not very uncommon, nor is acute inflammation of the cyst itself a rare event. If the patient recover well from the operation, the drain upon her strength by the re-secretion of fluid which rapidly takes place is greater than would have occurred had the cyst been allowed to remain full, and a second operation becomes needful, to be followed at a still shorter interval by demand for a third. Whilst, therefore, it is fully granted that in certain cases this method results in great temporary relief to the patient, that it may enable a woman who had been wholly incapacitated to get about in comfort for a few weeks, or, it may be, for a few months, still there is, I think, as little doubt that it is in the long-run prejudicial to the prospect of life. We must also recollect that in numerous cases,—those, for example, of multilocular tumours,—in which no one cyst greatly predominates in size, paracentesis can do little or nothing even for the reduction of the patient's bulk.

Various means have been devised with the hope of securing *obliteration of the cyst-cavity after paracentesis*. Amongst the chief of these we have: 1st, the application of very firm pressure over the abdomen; 2d, the exhibition of mercury; 3d, the injection of iodine into the interior of the cyst; and, lastly, the attempt to establish fistulæ, by which the re-secreted fluid may drain away.

The idea of preventing the refilling of a cyst by sheer *mechanical compression*, from without, is not one, at first sight, likely to claim our approval. It is, moreover, impossible to compress an ovarian cyst above; and firm lateral support will very probably only cause greater inconvenience to respiration by compelling the cyst to bulge upwards. Although a few cases of supposed cures, under treatment by starch-bandage applied to the abdomen, combined with the free administration of mercury internally, are on record, yet the plan has, even by the confession of its advocates, enough of drawbacks to prevent its coming into use; and it is, I believe, at the present time not resorted to by any Surgeons.

The establishment of *fistulous channels* communicating with the interior of the cyst may be effected either through the abdominal wall or into the vagina or rectum. After tapping the cyst a flexible catheter is passed through the canula, and, the latter having been withdrawn, is there retained. The disadvantages of this plan are such as to have led to its almost entire disuse. It is attended by great risk to life, probably not less than that attaching to ovariectomy. It attempts the obliteration of only one cyst; it is a long, painful, and exhausting method; and lastly, even when cure has been obtained, there is no certainty that it will prove permanent.

In some cases, instead of establishing a small fistula by means of a retained catheter, a large opening has been made into the cyst by incision, and the edges of it carefully secured to those of the wound in the integument. The drawbacks just enumerated will be found at least equally real in respect to this method also.

The plan which, next to that of the entire removal, seems to promise most as a means of radical cure, is that by *injection of iodine*. In certain cases of single cysts this method is certainly very useful, and with due caution is attended by but little risk. Still we must bear in mind that the dangers consequent on a mistake in the differential diagnosis between ascites and ovarian disease are much greater if iodine be injected than if ovariectomy be attempted. Such mistakes have occurred; and it is precisely in the cases most suitable (were the diagnosis correct) for injection treatment—those, namely, of thin-walled single cysts—that the mistake is most likely to happen. Then, again, if the tumour be multilocular, it is exceedingly probable that the secondary cysts will be irritated by the inflammatory processes set up in the larger one. Even when the chief cyst has to all appearance been permanently obliterated, the Surgeon can never feel confident that there may not be others left behind it, which, sooner or later, will enlarge. To these drawbacks we must add that, even in the most suitable cases, it is quite possible that the patient may be poisoned by the iodine, or may sink under the attack of cyst-inflammation which follows its use.

Premising that the injection method is only admissible in the case of tumours believed to be monocystic, it may be admitted, I think, that it exposes the patient to less risk in the whole than does ovariectomy. In this class of cases it is probable that it will continue to be occasionally employed. There are several different methods in which it may be practised. Either the iodine may be diluted in a large quantity of water, or it may be employed in a concentrated solution. The former was the method recommended by its introducer, Boinet; the latter is the one which has of late been considered preferable. The free dilution of the fluid diminishes the caustic action of the iodine on the lining membrane of the cyst, whilst it much favours its absorption into the patient's blood. Even with the most careful endeavours to empty the cyst, there always must remain in its interior a certain quantity of fluid, quite sufficient to dilute the most concentrated injection which could be employed.

In performing injection the cyst-fluid should first be evacuated, in the usual way, by paracentesis, the patient being on her side in bed. When the cyst is three parts emptied, a flexible catheter should be passed down the canula. This should be sufficiently large to fill the canula, and both should be retained. The cyst-fluid should be patiently allowed to drain away as completely as possible, the patient's posture being changed as may seem most suitable to this end. When no more fluid can be obtained, the iodine solution is to be injected, and, having been retained for ten minutes or a quarter of an hour, may be allowed again to drain out. Finally, the catheter and canula are to be withdrawn together, in doing which the Surgeon must be very careful to have his finger over the end of the former, to prevent the escape of drops of iodine-fluid into the peritoneum, during the passage of the end of the instrument through the wound.

The after-treatment must consist in the use of ice, and of stimulants or opiates, according to the symptoms which may arise. If, in performing the preliminary paracentesis in a case in which it is intended to inject, the fluid should be found too thick readily to escape by the canula, this plan of treatment should, I think, be abandoned, since it is very probable that the tumour is polycystic; and even if not, the mere density of the fluid will very greatly prevent the efficiency of the injection.

Having thus briefly adverted to the less complete of the attempts at radical cure, we now come to what may be considered one of the boldest innovations of modern surgery,—the *practice of complete extirpation*. This method has the advantage over all others, that it holds out the hope of permanent cure without any danger of relapse, and that also it is equally well adapted to the multilocular as to the single cysts. In the majority of successful cases it has the further merit of causing to the patient remarkably little suffering. I think it may also be alleged in its favour that should an error have been made in diagnosis, less risk is run in an attempt at extirpa-

tion than would be by any one of the other radical methods. The large amount of immediate risk to life which attends this formidable operation is its one great drawback. Few practical questions have occupied more of the attention of the profession, both at home and abroad, during the last ten years than this: whether the immediate risks of ovariectomy outweigh its advantages. Although many details as to modes of operating, &c., still remain to be decided, yet the verdict on the main question may be said to be given. The discussion has been carried on most openly; facts and statistics have been scrutinised most keenly, and the result is that ovariectomy is becoming more and more common; that it has recently been practised in almost every hospital in London, while it is gradually extending both in America and on the Continent. Simultaneously with the increased favour which ovariectomy has gained, the other methods of radical cure have fallen into comparative disuse. I shall not occupy space here with any attempt to enter into this discussion, but, venturing to assume that the operation does not now need any defence, shall proceed at once to consider the important practical details of its performance. First, let it be remarked that no impression can be more false than that the extirpation of an ovarian tumour is a procedure requiring but little surgical skill or forethought, and making demands only upon the Surgeon's courage, or, it may be, in the estimation of some, his recklessness. Perhaps there is no operation in surgery presenting greater scope for ingenuity, and requiring more prompt attention to numerous details in its performance.

The operation. In preparation for ovariectomy, the Surgeon should be provided, in addition to scalpels, director, &c., with at least two large trocars of half-inch bore, two or three strong vulsellum forceps, and two clamps; some gilt harelip-pins or silver-wire sutures and strong hemp ligatures. Some strips of new flannel, and several large, unused sponges, made soft by scalding, should also be at hand. The operation should be performed in the room where the patient is to remain, and it should be a large and well-ventilated one. If the weather be not hot, the temperature of the room should be raised to 70° or 75°, and the air moistened with steam. With regard to special preparation of the patient, nothing is needful beyond the ascertaining that her bowels have been opened on the previous day, and that she is in usual health. It is especially desirable to abstain from disturbing her stomach by the previous administration of useless drugs. As the operation may be prolonged, she should be warmly clad on those parts which it will not be requisite to expose, and precautions should be taken to prevent her dress from being wetted by the fluid. Chloroform having been administered, an assistant should introduce a catheter and empty the bladder. The patient should be placed on her back with her shoulders elevated by pillows, her feet resting on a chair and the abdomen well exposed. The operator now commences his incision about two inches below the umbilicus, and carries it downwards in the median line about four inches. With a few touches of the knife, and using the director or not, as may seem best to him, he rapidly divides the fascia and lays bare the peritoneum. There is rarely any bleeding if the median line be carefully kept to. The peritoneum having been opened to nearly the full extent of the wound, the cyst itself is exposed, and at the same time in most cases a certain amount of ascitic fluid escapes. The next step is to ascertain whether or not adhesions are present. This in many cases is evident to the eye; but if not, is easily determined by introducing one or two fingers between the cyst and the peritoneum. It is needful at this point to be exceedingly careful not to mistake the peritoneum itself for the cyst-wall, and thus carry the finger between it and the transversalis fascia—an error which has, to my knowledge, occurred several times, and to different operators. If adhesions exist, they must be cautiously broken down, and for this purpose it may be necessary to introduce the entire hand. For several reasons it is very desirable to break down all the adhesions, as far as practicable, before tapping the cyst. Whilst the cyst is full, it supports the parietal peritoneum, and prevents risk of its detachment by the traction

necessary to tear them through; its pressure also diminishes the risk of bleeding. The operator—having ascertained that the cyst has no adhesion in front, or the adhesions, if present, having been broken through—next introduces a large trocar into the most prominent part of the cyst. At this juncture it is well to turn the patient partly on her side. The best recipient for the fluid is a large glass funnel, fitted with india-rubber tubing. As the fluid escapes, the patient should be turned more and more over to her side, and her abdomen should be carefully compressed by assistants. When the tumour is three parts emptied, the operator may seize it with a vulsellum, and drag it forward carefully, at the same time attending to the trocar, that no fluid is allowed to run back into the wound. As the remaining fluid escapes, the cyst is gradually drawn out until it is wholly delivered; at which juncture the assistants should at once turn the patient again upon her back. A piece of flannel, from warm water, is now placed over the wound, the edges of which are held closely together by an assistant. The operator examines the pedicle, and determines as to the means by which to secure it; either the clamp or the ligature having been firmly applied, the bulk of the tumour is next cut away. It is well to cut it through at a distance of three or four inches from the seat of ligature, as by this means an effectual safeguard against slipping, and subsequent hæmorrhage, is obtained. With as little delay as possible, the external wound should now be closed; the Surgeon having, however, previously, with his finger, ascertained the state of the other ovary. The wound may be closed either with harelip-pins or by strong wire sutures, and these may be introduced either through the entire abdominal wall, including the peritoneum, or through its whole thickness, with the exception of the latter. They should be an inch and a half from the edge of the incision on each side, so as to have a firm grasp. They should not be more than three-quarters of an inch apart, and great care should be taken to carry the lowest as close as possible to the peduncle, or it may be well even to transfix the latter. Should the clamp be used, its handles are now to be removed, the portion of peduncle left on is to be wrapped in lint, the ends of the pins and those of the clamp are to be padded with lint, a large mass of cotton-wool may now be placed over the abdomen, and a four-tailed flannel bandage tightly applied over all. The patient should be returned to a warmed bed, and a suppository of two grains of opium may be introduced into the rectum. As a general rule, there will be no need for the administration of stimulants; but should the patient be faint, a little brandy may be given as an enema.

The *after-treatment* must vary according to the special symptoms which may present themselves; but we may venture to offer a few general suggestions. 1st. It is very desirable, in order to avoid vomiting, that the patient should take nothing by the mouth during the first twelve hours excepting a little ice; above all, no opium or other medicine should be so given. 2d. There is reason to believe that the chance of recovery in many cases has been much diminished by the too hasty, and too free, resort to opium and stimulants. The Surgeon should watch carefully, and give or withhold these remedies as the patient's state may demand. In not a few cases neither the one nor the other will be necessary. 3d. If the patient be low, she should be nourished by enemata of milk or beef-tea, to which, if needful, wine or brandy may be added. 4th. If the stomach remain irritable for some days, it is desirable, as long as such is the case, to continue the use of enemata instead of giving food by the mouth. 5th. It can scarcely be needful to insist that there should be a plentiful supply of fresh air to the sick-room.

Traumatic peritonitis is, without doubt, the chief cause of death after ovariectomy. It may commence within a few hours of the operation, and many patients sink from the shock of its initial stage. Many of the deaths attributed to "exhaustion" have, in all probability, been really due to commencing peritonitis. In those cases which wholly escape peritonitis, the recovery is usually most rapid; the patient, in fact, scarcely experiencing a single ill symptom. The earliest signs of peritonitis are pricking and

shooting pain in the abdomen, a peculiar pallor of the cheeks,* and an anxious expression of countenance, with frontal headache. The pulse becomes quicker and smaller, the skin hot, the tongue a little dry, and there is almost always more or less of sickness. Sometimes the patient scarcely complains of pain, excepting what is caused by the shake of vomiting. At a later stage the face may become flushed, and the skin pungently hot, whilst at the same time the pulse is rapid and very small. The concurrence of a very hot dry skin, with a thready, scarcely perceptible pulse, may be observed now and then in severe cases, and is a sign of most evil omen. Distension of the stomach with flatus is a common and distressing symptom, and at a later stage the intestines also become involved, and the abdomen is full and tympanitic. Peritonitis, after ovariectomy, may be either local or general. If it extend no further than the parts immediately adjacent to the pedicle and wound, it is protective rather than otherwise, since it tends to exclude irritating matters from the general cavity. In cases, however, in which the peritonitis is encysted, and involves but a small part of the sac, very profuse discharge may yet take place, and the patient may sink ultimately from exhaustion. If, in the first instance, the whole sac be involved, it is, I suspect, very unusual for any other than a rapidly fatal event to ensue. The treatment of peritonitis will be local and general. Locally it is well in the first instance, indeed as early as possible, to apply leeches freely, and these may be followed by a large hot poultice. The relief afforded by a large linseed poultice covering the whole abdomen is often very decided. On the other hand, the application of ice has its advocates, and it would not be difficult to explain how both heat and cold may each be beneficial. Venesection may in certain sthenic cases be resorted to with advantage. Opinions differ widely as to whether mercury is of benefit in traumatic inflammations; my own impression is very decidedly in its favour; and in early stages of the disease I should be inclined to push it freely, in combination with full doses of opium. The practice, too often pursued, of pouring in stimulants, is not, I think, one to be recommended, either on theoretic or clinical grounds; but the patient must be most carefully watched, for remedies of this class will undoubtedly become necessary at a subsequent period.

With regard to the management of the wound, the following hints may be given. The portion of pedicle or of cyst left above the clamp should be cut close away on the day following the operation, as there will then be no risk of slipping, and it is very desirable to avoid fœtor. The clamp itself may be removed on the second or third day. The harelip-pins should be left to the fourth or fifth; and when they are removed, the greatest possible care should be taken to support the abdomen and wound, by long and broad strips of plaster, and the firm application of the flannel bandage.

In a successful case of ovariectomy the patient will often be able on the second day, or it may be even on the first, to take food by the stomach without risk. In not a few the progress of recovery is as rapid as it usually is after a favourable childbirth; and the patient may be able to leave her bed on the tenth day, or from that to a fortnight or three weeks. If, however, suppurative peritonitis have occurred, the convalescence will be much delayed. There will probably be profuse discharge from the wound; and to secure the escape of this, it will be needful to turn the patient on her side at the time of

* In florid patients, the face may from the first be flushed instead of pale, but I feel sure that pallor is its most frequent condition. In some of the most severe cases of traumatic peritonitis which I have seen, the patient looked in the early stage as pale as if she had been profusely bled. I have not mentioned rigors as an early symptom. Many cases of peritonitis set in without any marked shivering fit; sometimes a slight feeling of faintness, which rapidly passes off, and then returns again, appears to take the place of a true rigor. Later in the case, after the peritonitis is well established, occasional shivering is rarely absent, but, at the same time, it is not often severe.

each dressing. In such cases, the patient is fortunate if able to leave her bed at the end of a month or six weeks. In most cases in which the peduncle is left in the abdomen, more or less of suppuration from within must be expected. In those in which the opposite practice is adopted, the wound usually heals by first intention.

Having thus sketched briefly the course of an ordinary operation, and the after-management of the patient, there yet remain certain occasional difficulties and certain moot questions of treatment which demand more detailed consideration. To take them seriatim.

Is the long or the short incision preferable? There has been much confusion in the description of cases as to which should be assigned to one or the other category. The distinction is purely arbitrary. Should the incision be measured before the removal of the tumour or afterwards? for one which would be considered long whilst the abdominal walls were distended might count as short when they had collapsed. Experienced ovariologists are, I think, all agreed that a few inches more or less in the length of the wound do not constitute an important element in the chance of recovery. All will also admit that it is far better to enlarge the incision than to lose much time in futile endeavours to extract a multilocular tumour through a small one. On the other hand, no one will contend that a patient has any better chance on account of a large incision. We come, then, to the conclusion that the first incision should be of medium extent, and that the Surgeon should be prepared to enlarge it if needful. About four inches, or just large enough to admit the knuckles, is perhaps a fair average measure; but in a few cases, in which there may be good reason to believe that the cyst is single, a much smaller one may be tried.

Adhesions. I have already insisted on the importance of detaching adhesions as much as possible before the fluid is evacuated. For this purpose, if the adhesions are extensive, it is usually necessary to introduce the whole hand, and, carrying it between the peritoneum and cyst, by a lateral movement, break through all connecting bands. Not unfrequently, however, the more important adhesions are found behind the cyst, uniting it to the viscera, or to the lumbar or pelvic peritoneum. These cannot, as a rule, be reached until the cyst has been partially emptied. In separating these, great care must be taken not to drag too forcibly on the peritoneum. Not only may injury be done by tearing up the serous membrane from its attachments, but lacerations of viscera or of large vessels may occur. The movement employed should still be as much by a lateral sweep, and as little by direct pulling, as possible. The peritoneum should be supported by the other hand, or by other fingers of the same. It is better, under all circumstances, to tear rather than cut; but when important viscera are involved, such as the intestines or gall-bladder, it may become needful to resort to a careful dissection.

That the existence of adhesions to a moderate extent does not materially prejudice the patient's prospects is generally admitted. There seems to be less danger of acute diffuse peritonitis in such cases than in those in which the integrity of the serous sac has never before been interfered with. On the other hand, adhesions prolong the operation and cause risk of hæmorrhage, and in these respects are prejudicial. If very extensive or very strong, they may constitute a serious complication.

Adhesions to the omentum are very frequent, but are for the most part easily dealt with. If very vascular, the omentum may be tied, and the end brought out into the wound.*

A special difficulty caused by adhesions in front. In cases in which the adhesions to the parietal peritoneum at the place of incision are intimate, great difficulty may occur in distinguishing the cyst. The operator may mistake the cellular interspace between the transversalis fascia and the parietal

* Mr. John Clay has devised an "adhesion-clam" for holding bands of adhesion whilst they are cauterised or rubbed through, &c.

peritoneum for that between the cyst and the latter, and proceed to break down the connecting tissue. This error, although hitherto little if at all mentioned, has repeatedly occurred; and it is one which, if not very quickly discovered, may lead to great damage. On the other hand, the Surgeon may, in his anxiety to avoid this, commit another. He may incise the visceral peritoneum of the cyst, and proceed to separate it. This error is less serious than the other, but it may cause great difficulty and much loss of time. In many cases the exterior of the cyst, deprived of its peritoneum, is smooth, white, and glistening; the adhesions are cellular, and easily broken through; so that there is nothing whatever to apprise the operator of his mistake. I know of but one plan by which, in cases of perplexity, to avoid at once all risk of these two errors; and it is this: to enlarge the wound upwards until the peritoneal cavity is opened at a part where no adhesions exist. When once the operator's finger has touched intestine, he knows where he is, and may proceed to detach adhesions without any chance of mistake.

Multilocular cysts. The operator should always be provided with at least two trocars, so that he may, if needful, puncture any second cyst which may present itself. If the cysts be very numerous, and many of them of considerable size, it may greatly expedite the operation to cut freely into the largest with a scalpel, and then introduce the hand into the interior, and break down their dissepiments. Of course before this is done the cyst should have been partially withdrawn and secured, and the patient placed well over on her side. Or, instead of making a large incision into any one of them, the tumour may be dragged forwards, and each single one punctured individually as they appear in the wound.

Prevention of escape of cyst-fluid into the abdominal cavity. This is of very great importance. No single precaution is, I am convinced, more effectual in securing it than that of turning the patient over on her side. By this means a depending opening is given by which the fluid may escape, and the chance of its gaining access to the peritoneum is very greatly lessened.* The patient should be turned over to that side on which the intestines are supposed to lie, *i.e.* with that side uppermost from which the tumour is believed to originate. During the removal of the tumour, an assistant should most carefully keep the edges of the wound pressed together, and, after its completion, a piece of flannel should be at once carried over the wound, beneath the cyst. If by any chance cyst-fluid have escaped into the peritoneum, it is doubtful practice to do much in attempting to remove it. A piece of soft scalded sponge is better for the purpose than flannel; but too much painstaking in this matter would probably cause more danger than it would prevent.

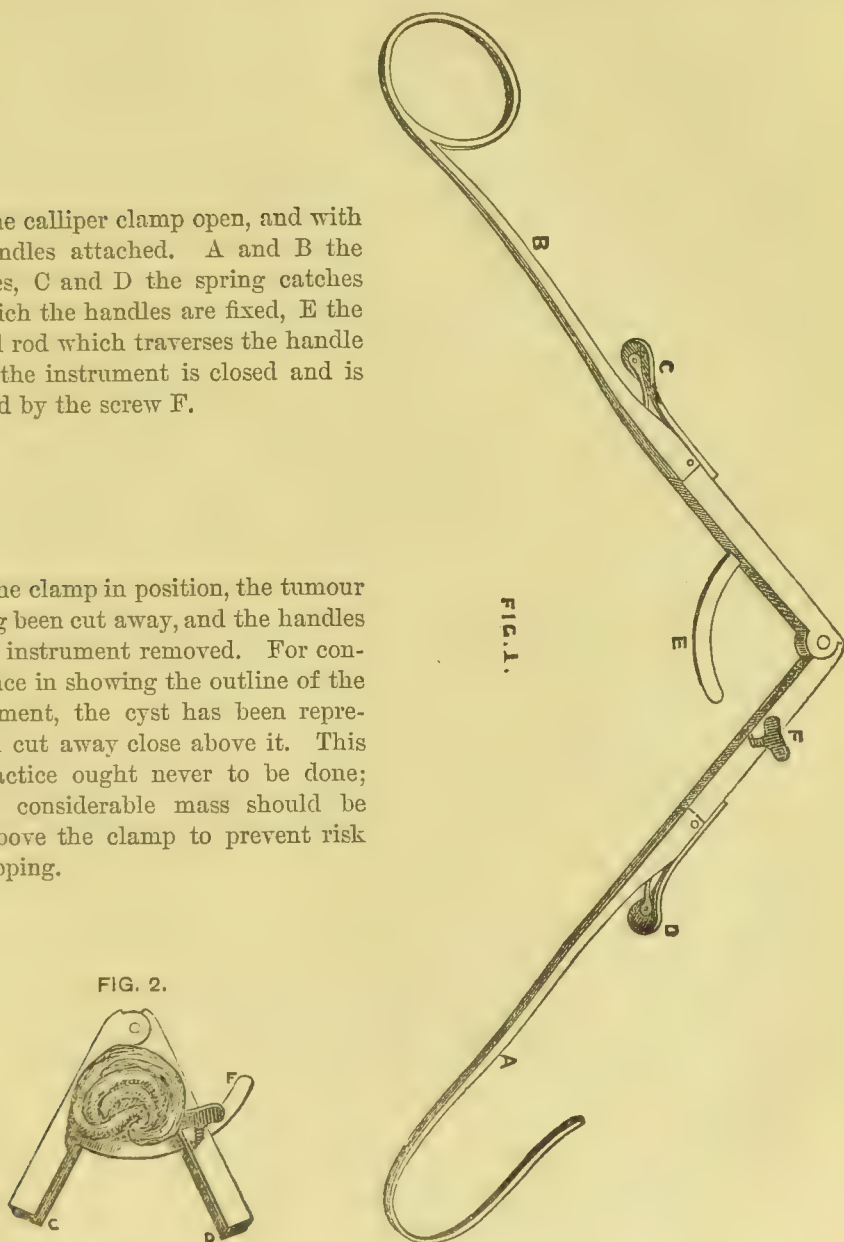
Management of the pedicle. The operator has his choice of numerous different methods of securing the peduncle, each of which has its advantages and its drawbacks. 1st. He may tie it with a hemp or strong silk ligature, either in one piece or by transfixing in two or more parts; and then, having cut away the tumour, allow the stump to slip back into the abdomen, the ends of the ligatures being brought out at the wound. The advantages of this method are, that there is no traction on the peduncle, and by leaving the ligatures on, they secure an open channel for the escape of pus, and also allow of their own safe removal when loose. Its disadvantages are, that the sloughy stump of the peduncle with its attached ligatures returned into the peritoneal sac are very likely to set up peritonitis. 2d. The peduncle may be tied as in the first method; and then, the ligatures having been cut close off, the whole may be returned, and the abdominal wound closed. In this plan it is hoped that the external wound will heal, and the portions of ligature left in the peritoneum become encysted, and cause no irritation. Nothing but the large amount of success which has recently followed the adoption of this most

* Mr. Spencer Wells has devised an ingenious and, I believe, very useful appendage to the ordinary canula, by which the slipping of the cyst is prevented. It consists of toothed springs, which clamp the cyst firmly to the sides of the canula.

unsurgical method appears to me to justify it. Its disadvantages as regards the probability of peritonitis, and the risk of hæmorrhage from slipping of the ligature (it being part of the plan to cut the peduncle close to the ligature), are patent. 3d. The peduncle may be divided by the *écraseur*. The time necessarily employed in dividing the peduncle, and the risk that

FIG. 1. The calliper clamp open, and with its handles attached. A and B the handles, C and D the spring catches by which the handles are fixed, E the curved rod which traverses the handle when the instrument is closed and is secured by the screw F.

FIG. 2. The clamp in position, the tumour having been cut away, and the handles of the instrument removed. For convenience in showing the outline of the instrument, the cyst has been represented cut away close above it. This in practice ought never to be done; but a considerable mass should be left above the clamp to prevent risk of slipping.



intra-abdominal hæmorrhage may subsequently occur, are the drawbacks to this plan. The first might probably count for little; but the latter, especially in the case of a thick vascular peduncle, is most grave. Its advantages are, that it entirely obviates the dangers incident to dragging on the peduncle, and at the same time leaves neither sloughy tissue nor ligatures in the peritoneal sac. In all the preceding methods the stump is returned into the abdomen under circumstances more or less unfavourable as regards the risk of its causing peritonitis. We now come to the plan which may probably be considered as

the one great improvement recently made in the operation. I allude, of course, to the principle of endeavouring to keep the end of the peduncle altogether out of the abdomen. This principle may be carried out either by the use of ligatures (hemp, silk, or metal), or by resort to a metal clamp. The latter instrument has the advantages that it can be applied easily and speedily, and with greater security as regards hæmorrhage. Various modifications in form have been proposed by different operators; but the most simple, and, I believe, the best, is one which resembles a pair of carpenter's callipers, but from which the handles are removable. It should be pressed tight with great force, and the screw by which it is fixed should be screwed down with the assistance of forceps to prevent all possibility of slipping. It is a good precaution to push two or three needles through the peduncle above the blades of the clamp, and an absolutely essential one to cut off the tumour at a considerable distance above it. In cases in which the peduncle is long and slender, the action of the clamp is most satisfactory, and no inconvenience whatever results from its use. In those, on the contrary, in which the peduncle is short, and still more in those in which a peduncle can scarcely be said to exist,—the base of the tumour itself occupying the entire expansion of the broad ligament,—the application of a clamp is difficult and inconvenient, and very hurtful traction on the uterus and pelvic peritoneum will be caused. The amount of traction may, in very thin patients, be not great at the time of the operation; but it will increase afterwards, should the abdomen become distended. How best to manage short peduncles is still one of the problems of the ovariologist. In some cases it may be practicable after the tumour has been cut away, and when, in all probability, the mass left on above the clamp has considerably shrunk, to reapply the clamp somewhat higher up. In order to effect this to best advantage, the operator should be provided with two clamps of similar size and make. One of these may be applied above the other, the screw having been, of course, removed from the lower one, and its handles being simply held together by an assistant. The lower clamp having been removed, the process may, if practicable, be repeated, and in this way an inch, or an inch and a half, might easily be gained in the length of the peduncle. It is true that part of the peduncle to be left in the wound will have been somewhat contused; but probably not so much as to endanger its vitality, or cause it to become a source of irritation. It may be borne in mind also that this portion will, should the abdominal parietes be thick, come in contact rather with the edges of the wound than with the peritoneum.

Closing of the external wound. This is an easy matter, and may be done with equal facility either by harelip-pins or silver wire. If pins are used, they must be gilt or silvered, not plain steel. The practice of Mr. Spencer Wells has proved that it is safe to pass the needles through the peritoneum; but it may be doubted if any material advantage is obtained. If not through the peritoneum, the ligature or pin should pass close to it through every thing else. It is always well to transfix the peduncle, and thus secure it firmly in the wound.

Why has ovariectomy been appreciated more highly of late years than formerly? The new method of keeping the end of the pedicle outside the abdomen is, I believe, the chief improvement of recent times. No doubt something has been done in the introduction of more cautious after-treatment, especially in the comparative disuse of opium. But chief amongst the reasons of the advance of ovariectomy in general favour is, *that it has been largely and openly tried.* Even in reference to the improvement in keeping the end of the pedicle out of the abdomen, if we put confidence in statistics, we

must admit that those of Dr. Clay and Mr. Walne, who did not adopt it, are at least as good as those of other operators.* Even at the present time ovariectomy, as practised in isolated cases, and especially in the large hospitals, is attended by a very great fatality. It is only in the hands of those who have had considerable experience of its details that its ratio of mortality begins to improve. The reason why the mortality in our large hospitals appears to have been so high is in part explainable by what has just been hinted at, and in part by the fact that all such cases are made public, whilst a large majority of the unsuccessful cases occurring in private are not so. Given a ward of equal size, and appropriated to the patient alone, it is difficult to see any reason why this operation should not be equally successful in connexion with large hospitals as with small ones; and further experience will in all probability show that it is so.

What may the average success of ovariectomy be expected to be? Those who allege that many fatal cases have been kept back, and that consequently statistics on this question are not trustworthy, have no doubt a certain amount of truth in support of their assertions. During the last eight or ten years several operators have, however, publicly undertaken to disclose their whole experience; and there is, I think, no doubt that they have most creditably done so. From their statistics we gather that two recoveries to one death is a proportion which, in practised hands, may be confidently expected, and that perhaps we may even very considerably improve on this. Mr. Clay's table of cases from all sources gives us 212 recoveries to 183 deaths; and making allowance for unpublished cases, I fear we cannot hope that the gross mortality of the past has been less than one-half. In reference to all operations, and especially to these, the practical Surgeon may most properly insist that deductions from general statistics are not to be applied too rigidly to individual cases. In many instances ovariectomy has been performed as a last resource, after the patient's powers had given way, and when the prospect of a favourable issue was very slight indeed. Now that the operation is fairly established in public confidence, we may expect that a considerable improvement in general results will follow, from the circumstance that a larger number of cases will be submitted to it at early periods of the disease. Although the results, even in many unhopeful cases, have been such

* Those of Dr. Tyler Smith, whose practice it is to cut off the ligatures short and return the whole are perhaps the best yet obtained. They are, however, only limited in number.

that the ovariologist scarcely feels justified in positively refusing to operate in any, yet there can be no doubt that it would be easy to select a certain number in which, if the credit of surgery is to be had in account, it would be wiser to decline it. Such are cases in which there is a history of severe attacks of peritonitis at some distant time; cases in which the tumour has existed for unusually long periods; and cases in which tapping has been very frequently performed, and the patient's strength has been greatly undermined. In the following remarks on the advantages accruing from the operation, as established by reference to arithmetic, I have, as will be seen, taken the lowest estimate of success, and in several other respects I have given the operation a less favourable position than it may, I believe, legitimately claim.

Remarks on the advantages of ovariectomy, as shown by statistics.
To compare its results with those of lithotomy, amputation, &c. is very much beside the mark, since operations performed with such differing objects, and under such different circumstances, afford no fair comparison. Each one must be considered on its own merits. The test I would propose is this: Let it be admitted that the object of surgery is the increase of the sum of human life, and the lessening of its disabilities and miseries. Whether this life is enjoyed by many individuals over short periods, or by few over long ones, is not of moment, if the sum of it be increased. If, then, we have 100 patients suffering from ovarian disease, and there is a fair probability that if all submit to ovariectomy, one-half will recover from the operation and be restored to perfect and, *quoad* the disease, permanent health, the calculation to be made will be simply a comparison of the sum of years which the 100 would have realised if not operated on, with that which the 50 recovered patients might be expected to attain. The ovariologist can, I think, well afford to leave out of question the not unimportant factor, that the 100 would have been sufferers, many of them in an extreme degree, throughout the entire remainder of their lives; whilst the 50 would have been in the enjoyment, for the most part, of excellent health. Of 100 patients suffering from ovarian dropsy, in the stage in which such cases usually come under care with a view to the operation, it is exceedingly probable that for half of them twelve months would be the limit of life; 25 others might perhaps be expected to die within two years; and the remaining 25 would probably follow at various periods within ten years. If therefore we allow three years and a half as the average expectation of life to the whole, it will, I think, be admitted that it is a liberal calculation, and probably much

higher than any Surgeon would advise an Insurance Office to accept them at. The average age at which women submit to ovariectomy is 35, and the average expectation of life at this age is 30 years. The 50 patients who recovered might, therefore, expect to enjoy a total of 1500 years of health, which compares very favourably with the 350 years of illness which the whole 100 would have had to endure, if not operated on. If it be objected, that it is not just to one person to deprive her of four years of life in order that another may live 30, the reply is, that this is a matter for the patient to consider, and not the Surgeon. It is part of the general lottery of life, and each patient takes her chance of a small loss or a large gain. All that the honest Surgeon is responsible for is, that the prizes which he offers to the competition of his clients shall be *bonâ fide*, and in sum of value far exceeding the deposits which he exacts.

The only source of fallacy which I can see in this argument is the possibility that a few of the cures might not be permanent. Either the other ovary might be attacked, or cancer might be developed in some other organ. To this it may be replied, that experience has fully proved that in almost all cases the cures after ovariectomy are genuine and permanent. The exceptions to this have been exceedingly rare.

Errors in diagnosis. The principal mistakes which have occurred have been in respect—1st, to solid, or partially solid, uterine tumours; 2d, to phantom tumours; 3d, to pregnancy; 4th, to ascites; and, 5th, to hydatid cysts. One general remark may be ventured in reference to them all, and it is this, that the Surgeon should place no trust in the patient's statements, but should, before undertaking any radical operation, carefully examine his patient by all practicable methods. A vaginal examination ought not to be omitted (unless the case is clear beyond a doubt), since in the very cases in which the Surgeon may feel most inclined to omit it (those, namely, of single women), it is the most likely that a misleading history may have been given. Keeping in mind that ovarian tumours ought to be perfectly dull in front, and should leave a tympanitic space in one or in both lumbar regions, there will rarely be much difficulty as regards ascites or phantom tumours. Should any doubt be felt, changes of the patient's position, and reëxamination by percussion, will generally clear it up in respect to the former; and the exhibition of chloroform in regard to the latter. I am not aware that any radical operation has ever been attempted in a case which proved to be one of simple pregnancy; but as in not a few such paracen-

tesis has been resorted to, we must always bear in mind the possibility of that error. In two or three cases of ovarian dropsy, complicated by existing but unrecognised pregnancy, ovariectomy has been performed, and in one at least with success. Provided the uterus is not interfered with, this is, perhaps, not a very dangerous blunder. The power which pregnant women possess of resisting severe injuries is remarkable. The differential diagnosis between uterine and ovarian tumours is by very far the most difficult of those under consideration, and under some circumstances may be impossible. The history of uterine hæmorrhage, the slower growth, the greater solidity,* more or less of fixation to the uterus, are symptoms by which those of uterine origin may usually be known. If there is doubt, it will be well to wait; for, provided the uterine tumour be innocent, it will not attain any enormous size, and may not improbably begin to diminish after a time.

Whilst an ovarian tumour is small, and especially in a fat abdomen, the establishment of a positive diagnosis may often be attended with insuperable difficulties. In cases, however, in which an operation is legitimately in question, the difficulties will usually have disappeared with the increase in size of the cyst. In cases of "phantom tumour" especially, the Surgeon may, not unfrequently, feel unable to assert the negative as to ovarian dropsy; but if he is satisfied that there is a clear percussion-note over any considerable extent of the front of the abdomen, he will of course decline to entertain the question of an operation. The usefulness of chloroform inhalation in affording facilities for clearing up these cases cannot be overrated.

FISTULÆ COMMUNICATING WITH THE VAGINA OR UTERUS.

Fistulous openings may exist—1st, between the urethra and vagina; 2d, between the bladder and vagina; 3d, between the bladder and uterus; 4th, between the vagina and rectum. In certain cases a common communication may open bladder, vagina, and rectum into one. We shall omit here all consideration of openings caused by the extension of cancerous ulceration, since they are quite beyond surgical treatment. The various forms of simple fistulæ usually

* Uterine fibroids not unfrequently soften in the centre, and present the symptom of fluctuation, more or less clearly marked. They often attain a size sufficient to distend the abdomen, as at the period of advanced pregnancy. On three different occasions patients have been sent to me with a view to the performance of ovariectomy, when, on careful examination, I satisfied both myself and others that the tumour in question was in reality uterine. In all these hæmorrhage had, at an earlier period, been a prominent symptom.

result either from contusions or lacerations in parturition, from the introduction of foreign bodies, or from the effects of calculous concretions in the bladder, or operations for their removal.

The inconvenience caused by any communication between the bladder and adjacent cavities is extreme, since it is usually attended by constant incontinence of urine. A large opening may, however, exist between the *rectum* and vagina without exposing the patient to much annoyance, since in many cases the involuntary escape of *feces* occurs only when the motions are unusually fluid. So great and so general has been the success obtained by operators in the cure of most of these forms of fistula, that it is scarcely worth while to occupy space by reference to less efficient modes of relief. It is admitted on all hands that, although by the use of the actual cautery small fistulæ may be much diminished, yet that they can very rarely indeed be made wholly to close, and the after-treatment in these cases is just as irksome as in those of operation. On the other hand, the results obtained by Dr. Bozeman, Mr. Brown, Mr. Bryant, Dr. Marion Sims, Professor Simpson, and Mr. Spencer Wells, have been so exceedingly satisfactory that we may fairly rank the operative cure of these distressing conditions as a finished achievement.

Considering the want of success which attended the attempts of the earlier Surgeons, some of whom (especially Dieffenbach) devoted attention very perseveringly to the subject, it suggests itself as a most interesting question in practice, to what precise improvements have recent results been due? Speaking chiefly of vesical fistulæ, I think we may mention the following as amongst the chief: 1st, the use of chloroform, which enables the operator to proceed with much increased facility in the difficult steps of the dissection; 2d, the use of metal sutures instead of silk; 3d, the avoidance of the vesical mucous membrane, both in the dissection and in the application of the sutures; and, lastly, increased attention to keeping the bladder empty afterwards. A few years ago much reliance was placed on metallic or wire shields, adjusted over the line of union; but these are now generally discarded, and reliance placed on sutures alone.

The following are the steps of the operation in a case of vesico-vaginal fistula: The patient should be in her best state of health, and the bowels should have been well cleared out. Chloroform having been given, the woman is placed either on her side, with the knees well drawn up, or in the usual lithotomy position. The parts being well exposed by the duck-bill speculum, and the nates being held widely apart by an assistant, the operator proceeds to drag the opening as low down as possible, with a view to facilitate the paring of the edges. This may be accomplished either by hooks, blunt or sharp; by the use of a metal suture; or by the introduction of a flexible

sound by the urethra, which is brought out again through the fistula, and then bent backwards. This latter plan furnishes the Surgeon with a most efficient hook, and one which cannot easily slip. In paring the edges, it is necessary thoroughly to denude every part; for if the smallest portion of mucous membrane be left, it may prevent union. None of the mucous membrane of the bladder must be removed. The wound should present a bevelled oblique line, slanting from a large vaginal opening to a smaller vesical one. The denudation being complete and free, sutures are next to be introduced. These should be passed obliquely from at least a third of an inch outside the edge of the incision. They must not include the mucous membrane of the bladder. The tightening and tying of wire sutures is easily accomplished by the fingers. Care must be taken not to put them too tight, so as to invert the edge of the vaginal mucous membrane. The instruments used in these procedures consist of small knives, forceps, and needles of various construction. Startin's tubular needle for carrying wire is in most cases the best. Provided the precautions insisted on, as to avoidance of the mucous membrane of the bladder, be observed, it does not appear that there is such great difference in result from wire or silk ligatures as was at one time supposed. Still it is certain that wire is not more irritating than silk; and as it is at least equally easy to use, it may be considered preferable.

The after-treatment consists chiefly in great attention to keeping the bladder empty. A catheter, either the small silver one introduced by Dr. M. Sims, or a common flexible one, should be retained; and it should be a nurse's duty to see that the urine is constantly flowing. The catheter should be changed and cleaned twice daily; and if at any time the flow of urine stop, it should at once be examined. The patient must lie on her side, with the knees drawn up, and every attention must be paid to sustaining her general health.

The sutures may be left in almost indefinitely; and unless it is clear that the operation has failed, they should certainly not be removed till the ninth or tenth day. If cicatrisation has occurred, they will cause no inconvenience; and their retention a few days longer than is absolutely necessary is a matter of no consequence, whilst their premature removal is a very grave error. It is needless to say that their removal should be effected with every precaution.

The nearer the fistula is to the urethra, the more easy is the operation in performance, but the greater is the chance that it may fail. The difficulty in closing urethral fistula arises from the fact that the catheter necessarily presses upon the line of union.

In cases in which the fistula is very high up, or it may be even connects the bladder with the cervix uteri, certain modifications in the plan of operation will be required. It may even become desirable to obliterate the upper part of the vagina and to connect the uterus with the bladder, thus allowing the menstrual fluid to pass per vesicam, but preventing incontinence of urine.

The operation in cases of recto-vaginal fistula does not differ materially from that just described. The paring of the edges must be practised in a similar manner, and care must be taken to avoid the rectal mucous membrane. The bowels must be kept from acting for ten days subsequently, and it may be well also to retain a catheter in the bladder. Whether or not the sphincter ani should be divided will depend upon the degree of tension which is present when the parts are brought together. It is not a slight measure, and should not be needlessly resorted to. In these, as in the preceding cases, the unencumbered suture of twisted wire is better than any form of compress or button, and far better than the shotted one. The vagina should be washed out by injections of tepid water daily.

JONATHAN HUTCHINSON.

DISEASES OF THE MALE ORGANS OF GENERATION.

FAILURES IN DEVELOPMENT OF THE TESTICLE.

THERE are two peculiarities in the development of the testicle which deserve notice here, forasmuch as they are related to certain peculiarities in the pathology of the organ. *First.* Each testicle is formed from two distinct parts. The *body* of the gland is produced from primitive foetal structure in front of, but apparently independent of, the Wolffian body, or temporary kidney, which lies along the hinder wall of the abdomen; whereas the *epididymis* is evolved from the lower part of the Wolffian body itself, and from the duct of that body, the vas deferens being the continuation of the Wolffian duct to the lower and hinder part of the bladder.* Reminiscences of this mode of development are furnished by the vessels which supply the two parts. The spermatic artery, derived from the aorta a little below the renal arteries, is distributed chiefly to the body of the testicle; and the deferential artery, from the hypogastric, is distributed to the vas deferens and part of the epididymis, the remainder of the epididymis being supplied by the anastomosing branch between the spermatic and the deferential arteries. The close sympathy also of the epididymis with the several parts of the urinary apparatus, particularly with the prostatic part, evinced in the frequent excitation of inflammation in it by irritation in the urethra, bladder, or kidney, and the manner in which that inflammation is commonly confined to it, without spreading to the body of the testicle, are probably, in some measure, due to the mode of development of the organ.

The *second* peculiarity is the change of position from the lumbar region to the scrotum, which takes place gradually during the foetal state, and is usually accomplished before birth. The physiological purpose of this change of position, and the means by which it is effected, are not quite clear. Viewing it in a pathological light, we feel that had the testicle been retained in the abdomen, and possessed the same sympathies and liabilities to disease which it now has, it would have proved a troublesome companion to the

* Kölliker, *Entwicklungsgeschichte des Menschen und der höheren Thiere*, p. 443.

other viscera. At the same time it would have been less exposed to injury, and the many maladies consequent on its passage through the abdominal wall would have been spared. We must not forget that the covering of peritoneum which it acquires in its course is a considerable protection against injury and against the extension of disease from the skin and superficial structures of the scrotum.

The question of *supernumerary testicles* may be dismissed with the statement that there is no clear evidence of one having ever been met with. The claimant to this distinction has in each case, when it has been submitted to dissection or to careful examination, proved to be either a cyst or a fatty or fibrous tumour in the cord or in some part of the scrotum, or a piece of omentum.

Imperfect development. In some few instances there has been complete absence of one or of both testicles, accompanied occasionally, but not always, by more or less deficiency of the other parts of the generative apparatus. It is remarkable that the vas deferens and vesicula seminalis should be present and grow when the testicle is absent; and it is still more remarkable that in some cases of deficient testicle, the vas deferens of natural size, or nearly so, has been traced into and through the inguinal canal.*

The cases in which the vas deferens has been found deficient in some part of its course are more numerous. The deficiency occurs most frequently near the testicle, occasionally near the bladder, and more rarely in its whole length. In some of these cases the epididymis has been also absent; but in others it was present, and was, like the testicle, as large as usual. These varieties do not admit of precise explanation in the present state of our knowledge of the mode of development of the organs; but they show that the development and growth of the several parts of the genital apparatus may go on independently of one another, however essential each may be to the function of the others. Both testicle and vesicula seminalis may be well formed, and may continue to be well nourished, though entirely useless, from the want of a vas deferens to connect the one with the other; so that the plumpness of a testicle and its

* Case and résumé of cases by Mr. Paget, *Med. Gazette*, vol. xxix. p. 817; also Curling, *Diseases of the Testis*, 1856, p. 3. Ernest Godard has investigated the subject of deficiency of the testicle and seminal apparatus with greater assiduity than any other person. *Recherches sur les monorchides et les cryptorchides chez l'homme*, Paris, 1856. *Etudes sur la monorchidie et la cryptorchidie chez l'homme*, Paris, 1857. *Etudes sur l'absence congéniale du testicule*, Paris, 1859. *Mémoires de la Société de Biologie*, 1856, p. 216; 1857, p. 382; 1859, vol. i. p. 311 and p. 327. See also Royers, *Des oblitérations des voies spermatiques*, in Canstatt's *Jahresbericht*, 1858, vol. iii. p. 383.

descent into the scrotum are no certain indications of the performance of its function being possible.*

The independent growth and secretion of the vesiculæ seminales explains the fact, that the person in whom the testes are absent or wasted may possess virile power, though of course he will be sterile. A man æt. forty-four, whose scrotum is small and the testes can scarcely be said to exist, the vas deferens on either side terminating in a small firmish lump, which appears to be a diminutive epididymis and which is very tender, tells me that he has by no means a want of sexual propensity or power; on the contrary, he was very dissipated before marriage, and indulged every night for the first three years afterwards; but never had children. To the best of his belief, the testes have been in their present condition from birth; at least he never knew them to be otherwise. When he was eight years old, disease, probably gonorrhœa, was communicated to him by a maid-servant, who was transported for seven years for the offence. Whether this had any effect upon the organs he cannot tell. He has beard and moustache, and presents no indications of want of virility.

A gentleman, from whom both testicles had been removed, informed me that the operation had caused no difference in his sexual inclination and power. I should add, however, another patient similarly circumstanced told me that he was impotent soon after the loss of the organs.

Retention of testicle. The descent of the testicle is delayed till a few months, or a year, after birth in about one infant in five. It may take place later. Sir A. Cooper has "many times seen the testes descending from thirteen to seventeen years, probably from new excitement at that period; and the descent is in some cases not accomplished till twenty-one." Under these circumstances the testicle is liable to be accompanied or followed by a portion of intestine, forming a "congenital hernia," and not unfrequently the bowel is adherent to the gland.† In about one person in a thousand one of the testicles (the right or the left in a nearly equal proportion of

* The experiments on animals by Sir A. Cooper, *On the Testis*, p. 51; Mr. Curling, *Diseases of the Testis*, p. 11; and M. Gosselin, *Archives Générales de Médecine*, Sept. 1853, indicate that the division of the vas deferens has little or no influence upon the nutrition of the testicle; and atrophy or removal of a testicle is not usually followed by wasting of the corresponding vesicula seminalis.

† That hernia is not always an attendant on late descent of the testicle is proved by Malgaigne's case of a boy æt. thirteen, whose left testicle suddenly descended into the groin in consequence of a fall, and was not followed by rupture. *Anat. Chirurg.* vol. ii. p. 266. I was lately consulted, for inflammation of the bladder, by a patient æt. sixty, both of whose testicles were retained and did not pass the external ring till he was forty. The protrusion was regarded as rupture, and its further progress prevented by a double truss. He married a woman older than himself

cases) is permanently retained in the abdominal cavity or in the inguinal canal or the groin. In a few instances this happens with both testicles. The cause of the failure is probably, in most cases, a deficiency in the force, whether it be the contraction of the fibres of the gubernaculum or some other, by which the descent of the gland is effected. Sometimes there has been an impediment to the process, either narrowness of one of the inguinal rings, or an obstacle in the inguinal canal, or adhesions to some of the viscera or to the abdominal wall, consequent on intra-uterine peritonitis, or an imperfect development of the "mesorchium." Shortness of the vas deferens or other vessels may also be mentioned among the causes of failure of descent of the testicle; though in several instances they have been shown by dissection to be tortuously disposed.*

The condition of the imperfectly descended testicle has been a matter of anxious inquiry. It has, in a few instances, been found of full size;† but as a general rule, it is imperfectly formed, or smaller than natural, its glandular tissue retaining the immature characters of the infantile organ; or it may be atrophied, in a state of fibrous or fatty degeneration, and presenting scarcely any trace of glandular structure.‡ This may be in consequence of the position being less favourable than the scrotum is to its nutrition.§ Whether that be the cause or not, the relation between imperfection of development and incomplete passage to the scrotum is frequently to be observed. Although, therefore, it is quite possible, in any case, that the retained testicle may perform its functions, yet there must always be great suspicion of its inefficiency. Where the other testicle has descended and is natural, this is of little consequence, one testicle being quite sufficient for generative purposes; but where both testicles are retained, the virility must be a matter of anxiety and much uncertainty. Proofs, however, are not

when he was thirty, but never effected an entrance, because the emissions took place too soon.

* In each of three specimens of undescended testes in Guy's Museum, a peritoneal pouch occupies and projects a little beyond the inguinal canal, and there appears nothing in the canal to prevent the descent. The cause of its failure is not apparent in any case. The testicle in each is rather small.

† Cloquet, *Sur les Hernies abd.* Cooper, *On the Testis*. In this patient, who committed suicide, the gland was nearly of the natural size.

‡ *Brit. Med. Journal*, 1859, p. 110; report of discussion at Med.-Ch. Soc. *Curling*, p. 27; and *Brit. and For. Med. Ch. Rev.* April 1864.

§ This view is supported by the instances in which the testicle has been retained in the abdomen by adhesions, and yet has been stunted in its development or growth. *Trans. of Path. Soc.* vol. viii. p. 265; also by the case of a Parisian mentioned in *Med. Times and Gaz.* vol. xviii. p. 67, whose right testicle was suddenly and violently drawn up into the inguinal canal during masturbation when he was young, and never reappeared. The body of the testicle was found much atrophied, soft and pulpy, and but one-fifth of the size of its fellow.

wanting that impotence is no necessary result of this condition.* Some opinion may be formed by the presence or absence of those external indications and those propensities which are usual attendants upon virility. These, however, are not quite to be relied on as evidence of the power of impregnating the female; for in some cases of the kind there has been virility and seminal emissions during connexion and at other times, although there were no spermatozoa in the fluid and no power of impregnation.†

Diseases of retained testicle. The recorded instances of disease in the testicle when retained in the abdomen are few. In a case related by Dr. G. Johnson,‡ it was the seat of malignant disease. When in the inguinal canal it is as liable to inflammation from gonorrhœa as when it is in the scrotum; and the pain is more severe, in consequence of the confined position of the gland, and the pressure of the abdominal muscles upon it. In this situation it has been the seat of malignant disease;§ and it also sometimes suffers from the pressure of the muscles, especially about the time of puberty, or from being displaced by a sudden strain, and forced into a narrow part of the canal. In some instances of this last kind such repeated attacks of inflammation ensued as to necessitate the removal of the gland.|| The symptoms, under these circumstances, have been so violent as to be mistaken for hernia,¶ and have even led to an operation upon the tumour.** A correct diagnosis in such

* Hunter's Works, by Palmer, vol. iv. p. 18; Curling, p. 26; *Brit. Med. Jour.* 1859, p. 110; Poland, *Guy's Hosp. Reports*, 2d series, vol. i. p. 162. Mr. Coulson stated at the Med.-Chir. Soc. Jan. 11, 1859, that he was "consulted in a case in which neither testicle had descended into the scrotum, one being in the inguinal canal, and the other in the abdomen. This gentleman married and was able to perform his marital duties."

† *Med. Times and Gaz.* vol. xx. p. 101; *Trans. of Path. Soc.* vol. xi. 160. Godard, *Etudes sur l'absence congéniale du testicule*, entertains the view that a testicle which is arrested in its passage to the scrotum never secretes spermatozoa or fluid capable of impregnating the female. In a paper on sterility in man, with cases, read before the Med.-Chir. Soc. June 23, 1863, Mr. Curling observes that "spermatozoa have not been discovered after death in the spermatic rings of a detained testicle in any one instance that he knows of." Cryptorchies may be, and sometimes are, *virile*; but the facts which he has collected indicate that they are *sterile*; and he is inclined to call in question the claims to paternity which have been advanced in some of these cases. He speaks also of the effects of gonorrhœal epididymitis, tubercular deposits in the epididymis, and stricture of the urethra in causing sterility. See also *Brit. and For. Med. Ch. Review*, April 1864.

‡ *Medico-Chir. Trans.* vol. xlii. p. 15.

§ Mr. Arnott gives a case of this in *Med.-Ch. Trans.* vol. xxx. p. 9, and quotes others. Virchow, *Die Krankhaften Geschwülste*, remarks that the frequency of malignant disease in the testicle retained in this situation is due partly to the injuries to which it is subjected by the contractions of the abdominal muscles, and partly to predisposition associated with its imperfect development.

|| *Dublin Journal of Medical Science*, vol. xxvi. p. 257; *Medical Times and Gazette*, vol. xix. p. 379.

¶ Richter, in Lawrence *On Hernia*, fifth edition, p. 571; Pott's *Treatise on Ruptures*, p. 352.

** Deliasianne, *Revue Médicale*, 1840.

a case must be difficult, sometimes impossible. The Surgeon must be guided by the general symptoms. If, after the employment of the ordinary remedies, they continue to indicate strangulation of intestine, he should not hesitate to cut down upon the swelling, and ascertain the real nature of its contents. A testicle retained behind the abdominal ring in the inguinal canal, and inflamed, may be mistaken for bubo, the accompanying blush in the skin suggesting that suppuration has taken place. Ricord was nearly deceived by a case of the sort.* Sir A. Cooper observes, "it often happens that when a testis remains in the inguinal canal, there are severe spasms of the cremaster or muscles of that canal, accompanied with violent pain, and only relieved by the hot bath and by fomentation."†

Complication with hernia. Retained testicle is sometimes complicated with hernia, which may pass beyond the testicle through the inguinal canal; the hernia being contained in the same peritoneal pouch as the testicle. The complication may be embarrassing, from the testicle being unable to bear the pressure of the truss requisite to prevent the descent of the hernia. In the case of a lad, æt. nineteen, the suffering from the compression of the gland was so severe that Mr. Solly removed the organ.‡

If a portion of bowel accompanies the testicle, it should be replaced, the testicle being left in the scrotum, and a truss applied between the two. Should the bowel, however, be adherent to the testicle, so that either the latter must be kept in the abdomen or the

* *Prov. Med. Journal*, vol. vi. p. 264.

† In *Trans. of Path. Society*, vol. ix. p. 316, is the dissection of a large hydrocele in the right groin, the testicle being undeveloped and detained in the inguinal canal. Dr. Gherini (*Annali Universali di Med.* vol. clix. p. 118, and *Brit. and For. Med. Rev.* vol. xxi. p. 268) relates two cases. Fatal peritonitis followed the opening of one; the other was cured.

‡ Curling, *On Diseases of the Testis*, p. 41. The removal of a retained testicle is an operation not unattended with danger, forasmuch as the sac of the tunica vaginalis usually, though not always, communicates freely with the cavity of the peritoneum. In a case of neuralgic testicle, retained in the lower part of the inguinal canal, and removed by Prof. van Buren (*Amer. Med. Times*, Mar. 16, 1861), the tunica vaginalis was closed at the internal ring, and did not extend into the scrotum.

I would remark, as a matter of some practical importance, that when hernia occurs with retained testicle, and indeed in other cases of congenital hernia, the stricture, if strangulation takes place, is usually in the neck of the sac; and it may be at some distance behind the internal ring, a pouch being formed between the peritoneum and the fascia transversalis, in which some of the hernia is contained. I have met with two examples of this. In each the external abdominal ring was tight and constricted the hernia; and we might have supposed this was the real stricture, had not the finger discovered that the bowel above was not free, but tightly strangulated more than an inch above the internal ring.

In a young man, whose testicle had descended only just below the external ring, hernia suddenly took place and was strangulated. The bowel, instead of passing downwards into the scrotum, ascended upon the oblique muscle nearly to the spine of the ilium. By drawing it forcibly downwards, and then manipulating above the ring, I succeeded in replacing it.

patient remain the subject of hernia, the former alternative is to be preferred, and the descent of both testicle and hernia must be prevented by a truss. It has now and then happened that a portion of bowel has descended into the scrotum, instead of the testicle. In such a case, if it be an infant, I think it better to leave the case alone for a time, in the hope that the testicle may descend, and that it may be possible to return and retain the hernia by a truss, while the testicle remains in the scrotum. Should, however, the testicle not descend, the hernia must be treated by a truss, and both it and the testicle be kept in the abdomen.

We know no means of determining or accelerating the descent of the testicle. Attempts have been made by operation to withdraw the gland from the inguinal canal and place it in the scrotum; but they have not succeeded sufficiently to encourage the Surgeon to incur the risk of opening the cavities of the tunica vaginalis and the peritoneum, as well as the other dangers incidental to the operation.

Passage of the testicle into the perineum. In a few instances the testicle has passed beyond its proper bounds, and has become lodged in a pouch in the perineum. In this situation it is a source of much inconvenience, being liable to be bruised in sitting or riding, so that it is necessary to use mechanical means for retaining it in the scrotum. A patient with gonorrhœa complained of a painful swelling in the perineum; M. Ricord, supposing it to be a perineal abscess, was about to open it, but discovered it was the testicle. He met with another instance of the same kind.* Whether, in these cases, the testicle traverses the scrotum on its way to the perineum, or passes from the external inguinal ring directly backwards, between the thigh and the scrotum, instead of downwards and inwards to the scrotum, is not easy to determine. I was lately consulted by a gentleman, in whom the right testicle, of smaller size than the left, lay in the track just mentioned; that is to say, it was in the cleft between the scrotum and the thigh, having never entered the former, and the cord ran up from it straight to the

* *Prov. Med. Journ.* vol. vi. p. 264. In the *Brit. Med. Journ.* 1858, p. 549, is the account of a case in which the testicle was thought to have been dislocated into the perineum by a blow upon the pommel of a saddle. The gland remained in its abnormal position, an inch in front of the anus. An operation was attempted by Mr. Partridge, for the purpose of replacing the testicle in its position. This being unsuccessful, the organ was removed. It is not improbable that this testicle had descended into the perineum in infancy, but was not a source of annoyance till the injury upon the saddle. Dr. Zeis (*Archiv für Clinische Chirurgie*, vol. ii. p. 81) was about to operate on a lad, æt. 15, for stone in the bladder, when he found the left testicle in the perineum in the way of his intended incision, and he accordingly made the incision on the other side; the left side of the scrotum was very small. He quotes other cases of abnormal descent of the testicle into the perineum and crural region.

external ring. He was not accustomed to ride on horseback, and did not suffer much inconvenience from the malposition.

Passage of the testicle through the crural ring. Three cases of this 'are given by Mr. Curling: the testicle either making its exit through the saphenous opening and mounting upon the abdomen like a crural hernia, or lodging behind the fascia in the upper and inner part of the thigh.

Persistence of the canal between the tunica vaginalis and peritoneum. This canal usually closes in its whole length soon after the testicle has reached the scrotum. Often, however, the process is delayed for a variable time after birth in consequence, perhaps, of a hernia descending with the testicle; or the canal may be maintained by fluid secreted in the tunica vaginalis or in the peritoneum (it is not easy to tell which), and passing to and fro. In either case a remedy is to be found in a truss or pad applied upon the groin. Sometimes the closure is only partial, and spaces remain which may become distended with fluid, forming hydrocele of the cord; or a narrow channel may remain in the whole length, from the testicle to the abdomen, for years or for life. All Surgeons of much experience will be able to confirm the following observation by Sir A. Cooper: "The opening of the tunica vaginalis, in some instances, remains small until the adult age, and it then becomes suddenly dilated by a protrusion of intestine, producing hernia congenita; and when the Surgeon in the operation discovers its nature, the patient assures him that he never had a hernia until a few days before."*

Imperfect subsequent development. Even though the descent of the testicles may take place properly, their subsequent development and growth may fail.† In a single man, æt. thirty, who died in Addenbrooke's Hospital of phthisis, I found the testicles no larger than horse-beans. They presented no trace of disease, were soft and even on the surface, with the usual lobular divisions in their interior; but instead of the ordinary glandular structure, there was a reddish granular substance in which I could discover no tubules.

* This subject is more fully discussed in the essay on HERNIA, pp. 234 et sqq.

† Mr. Curling showed at the Pathological Society the undeveloped testes from a remarkably tall man, who had been through life almost hairless as regards the pubes, chin, and whiskers. Both testes were quite undeveloped, and though normal in structure, had not advanced beyond the state of early childhood. The man had never shown any signs of virility. He had not been deficient in intellect. *Med. Times and Gaz.* vol. xx. p. 76; *Trans. of Path. Soc.* vol. xi. p. 157. Several instances have been recorded where the testes and other parts of the genital apparatus had not attained their proper development and position in idiots and others of feeble mind. This, however, is not always, or even usually, the case. Indeed, we know that the organs are commonly well formed, and the sexual propensities, uncontrolled by the moral faculties, are a source of much trouble in the management of these persons.

The epididymes were also small; the vasa deferentia were of their natural size; the vesiculæ seminales about half as large as usual; the prostate and bladder healthy; the penis of natural size; hair on the pubes, a beard and proper muscular development.

Inversion. Now and then there is inversion of the part; the vas deferens and the epididymis presenting in front, and the body of the testicle being behind; and this may lead to difficulty of diagnosis when there is disease. The other day, examining a case of epididymitis, I was puzzled at finding the firm swelling in front and the soft part behind; soon, however, I discovered that the vas deferens descended along the fore-part of the cord, and that the epididymis lay in front. On the opposite side the parts were disposed as usual. The same inversion has been noticed occasionally in hydrocele (see following page).

HYDROCELE.

Of all diseases hydrocele of the tunica vaginalis testis is one of the most simple in its nature and the most easy of diagnosis and treatment. It consists merely in a preternatural accumulation of the fluid which naturally moistens the internal surface of the tunic. It is not of dropsical nature, and is not a usual attendant on dropsy; but is a purely local affection, the result of some change in the membrane, whereby the proper balance between secretion and absorption is lost. That change is probably of an inflammatory nature, or of the kind which some pathologists call irritation, that is, a condition akin to inflammation and easily passing into it. At any rate, it is often traceable to a blow or some cause likely to induce inflammation. Associated with the fluid we often find some of the ordinary products of inflammation, and it usually contains a larger proportion of the albuminous and saline constituents of the blood than are present in ordinary dropsical effusions. Sometimes fibrine is present, as indicated by spontaneous coagulation; or coagulation may be excited by the addition of a small quantity of the fibrine or red corpuscles of the blood.* Its specific gravity is about 1025; it contains rather less animal matter than serum, though more than the fluid of ascites or hydrothorax;† and there are sometimes blood-globules in various conditions, flakes of lymph, and, in elderly persons, fatty matter or particles of cholesterine floating in it. Now and

* Buchanan, in *Proceedings of Phil. Soc. of Glasgow*, 1845, Feb.; Schmidt, in *Reichert und Du-Bois Archiv*, 1861, p. 555; and Virchow, *Die Krankheiten des Menschen*, p. 157. See also *Natural History Review*, April 1864, p. 160.

† Marcet and Bostock, in *Med.-Chirurg. Trans.* vol. ii. p. 374, and vol. iv. p. 73. Simon's *Animal Chemistry*, by Day, vol. ii. p. 495.

then it is like milk;* on the whole, however, it is not very variable in its appearance or character. The quantity varies; usually it is under a pint, but sometimes amounts to several quarts. The hydrocele of Gibbon the historian is still, I believe, without a rival in this respect, the quantity removed by Mr. Cline in that case being six quarts.

There is commonly little change beyond the distension of the tunic caused by accumulation of the fluid. There is no vascularity, nor much thickening either of the sac or of the tissues external to it. Even the cremaster muscle undergoes little change; sometimes its fibres are rather coarse, more frequently they are thin and pale. The swelling has much the form which the tunic assumes when it is artificially stretched, after death, by the inflation of air or the injection of fluid into it; that is, it is pyriform, with the larger end downwards, and there is often a transverse constriction near the upper end. This constriction, which is also due to the shape of the tunic, as may be proved by blowing air into it, has often led to the supposition that there were two distinct sacs, or that there was a hernia in addition to the hydrocele.†

The *position* of the *testicle*, with regard to the tunic, regulates its position in the hydrocele; it is accordingly found at the lower and hinder part. The exceptions to this are few, and are commonly due to some change having taken place in the tunic, some unequal thickening of its coats, or adhesion of its surfaces, whereby the shape of its cavity is altered. Or there may have been congenital inversion of the organ, the epididymis presenting in front; in which case the testicle will be at the lower and *fore* part of the hydrocele.‡ Sometimes the testicle is in front, and we cannot quite account for the anomaly. As these varieties occasionally occur, the position of the testicle should in each be ascertained, if possible, before puncturing the hydrocele. For want of this precaution, I have, more than once, known the testicle pierced by the trocar, which was then either withdrawn or pushed on through the testicle into the hydrocele. No ill effect, beyond ecchymosis and slight inflammation, followed in these cases; but

* *Archives Gén. de Médecine*, cinq. série, vol. xvi. p. 111. In this case there were no spermatozoa, but possibly other spermatic elements.

† Sir B. Brodie (*Med. Gaz.* vol. xiii. p. 91) relates a case in which this "hour-glass contraction" increased so as to divide completely into two chambers a hydrocele which had been originally single.

‡ In a patient, æt. thirty-six, who died of phthisis, I found a hydrocele in the right side, of about the size of a pear. The part was turned round, so that the testicle with the epididymis and vas deferens presented in front. The walls of the hydrocele were thick and opaque, with straw-coloured calcareous plates and ridges upon its inner surface and in its substance. The body of the testicle was quite flattened, but of its usual size.

severe inflammation has followed this mistake in other instances. In children the testicle is said to occupy a lower relative position in hydrocele than in adults.

Condition of testicle. Usually the testicle is sound, retains its natural size, is placed vertically, and projects into the cavity, so that it cannot be distinguished by manipulation, unless the walls of the sac are flaccid. The sensations of the patient, when it is touched, are some guide to its position, but must not be relied on. Sometimes it becomes flattened and spread out by the pressure of the fluid and by the stretching to which it is subjected in common with the rest of the walls of the sac. The epididymis is then elongated, and the pouch, which naturally exists between the testicle and the epididymis, is obliterated. Sometimes, on the contrary, the testicle becomes separated from the hinder wall of the sac by an increase of the pouch just mentioned. This pouch, which projects towards the inner side of the testicle, may be so enlarged as to form a second sac, communicating with the larger sac by a neck, bounded in front by the testicle, and behind by the epididymis. Or the testicle may be projected into, even across, the hydrocelic cavity, and, together with the structure connecting it with the epididymis, may form a septum dividing the sac, more or less completely, into two compartments. When this occurs, an alteration usually takes place in the axis of the testicle, so that it lies transversely, and the septum is also transverse.

Other varieties occur in hydrocele. The sac may yield unequally, causing the shape to be more elongated or more spherical than usual; or circumscribed portions of the sac, yielding in a greater degree than the rest, may give rise to pouch-like dilatations, forming "bilocular" or "multilocular" hydrocele. Not long ago I dissected a hydrocele, which was covered all over with small pouches, communicating with the interior by narrow necks. Small cysts may be developed in the wall of the sac.*

Usually the wall of the sac remains thin and transparent for a long period, even though it is subjected to repeated tappings. Sometimes, however, especially if there have been an injury or effusion of blood into it from any cause, the tunica vaginalis becomes thick, opaque, and dense, even to cartilaginous consistence; and it may be the seat of earthy deposit. This may be uniform; or the interior of the tunic may be rendered uneven or knotty, by projecting masses or lines and bands of lymph. Under such circum-

* Museum of College of Surgeons, 2327.

stances, the testicle becomes flattened, and perhaps wasted by the pressure of the contracting lymph upon it. The structure of the testicle is rarely injured or atrophied except in old hydroceles, where the tunic has become thickened or coated with lymph. The effusion of lymph into the cavity may also lead to obliteration of parts of it, causing alterations in its shape, or adhesions between its surfaces at certain points, and to the formation of septa, dividing the sac into two or more compartments. These changes are probably, in most instances, consequent on the injection of irritating fluids into the cavity, for the purpose of effecting a cure, which has only partially succeeded.

Tubular prolongation to abdomen. The occasional persistence of tubular communication between the cavities of the tunica vaginalis and the peritoneum, constituting what has been called "congenital hydrocele," should also be borne in mind, and care should be taken in each case to ascertain whether it be so before injecting irritating fluids into the sac. Especially should this be done in children; and where there is hydrocele on both sides, in them, the suspicion of such a communication should always be entertained. An examination of the cord, and pressure upon the hydrocele, will usually decide the point, forasmuch as the fluid can be pressed from the tunica vaginalis into the abdominal cavity, and returns when the pressure is remitted. In this respect it resembles hernia, but there is not much difficulty in distinguishing between the affections. Besides being transparent, the swelling usually returns to some extent, although the patient be recumbent; and if the sac be emptied, it will gradually refill when the patient stands up, although the finger be pressed upon the inguinal canal with sufficient force to prevent the passage of a hernia. It must be observed that occasionally the tube connecting the hydrocelic cavity with that of the abdomen is so narrow as to escape detection when the cord is held between the finger and thumb; and it may even be so narrow as to permit the fluid to trickle very slowly from the hydrocele into the abdomen, so that its passage from one cavity to the other would escape observation on a cursory examination. There is a specimen of this kind in Guy's Museum. In such a case pressure upon the hydrocele, unless it is long continued, will make very little impression; and the nature of the case is likely not to be detected unless it have been remarked that the swelling is diminished when the patient has lain down some hours. Such cases, it is true, are rare; and I do not know of any in which mischief has resulted from the communication being overlooked, though I suspected it in one instance.

In each of the following cases it would seem that the canal remained pervious, except quite at the upper end; and that when hydrocele took place the sides of the canal yielded where it passed through the abdominal wall, and were also dilated into a considerable pouch behind the abdominal wall.

A man, æt. 35, had large hydrocele on the right side, with the usual transverse constriction near the upper part. It extended up to the inguinal ring, and received an impulse when he coughed. Examining the abdomen, I found a fluctuating swelling at the lower part, like a distended bladder; and a distinct impulse was communicated from this to the scrotal swelling, so that it was clear there were two sacs, one in the scrotum, the other in the abdomen, communicating through the inguinal canal. The history was obscure. The patient was unconscious of any swelling in the abdomen, yet had worn a truss for supposed rupture. The scrotal swelling was attributed to a blow on the pommel of a saddle ten years ago. It had gradually increased. A trocar passed through the scrotum gave vent to seven pints of serous fluid, emptying both sacs. The testicle lay at the inner and upper part of the scrotum. Pain and swelling of the left lower limb, with other indications of plugging and inflammation of the femoral vein, followed. These subsided, and the fluid was on three subsequent occasions drawn off. A more radical proceeding being desired, I made an incision into the swelling, and carried it up to the internal ring, so that there might be a free vent for the products of inflammation from the abdominal sac; then inserted lint. Suppuration ensued; and when the wound healed, the cavity was obliterated in its whole length.—Case II. A man, æt. 29, had hydrocele in the right side, extending through the inguinal canal into the abdomen, and causing a fulness above the internal ring. It resembled a hernia in its shape, in the impulse received by coughing, and in the fact that the testicle could be felt, apparently distinct from it, at the lower part; but it was transparent and fluctuating. It was attributed to a blow received ten years previously, and was said to have commenced in the scrotum. There was inguinal hernia on the opposite side. I cut into the swelling cautiously; and as the abdominal swelling was smaller than in the preceding case, I did not carry the incision so high, but passed lint along the canal into the abdomen. Suppuration followed, and the disease was cured.*

Diagnosis of hydrocele. The position and shape of the swelling, its termination below the external ring, so that the cord may be felt free above it, its lightness and fluctuation, and, above all, its transparency, furnish such ready means of diagnosis in the great majority of cases, that a mistake does not often occur. Still, as the requisite means of informing himself are so simple, the Surgeon should not neglect to employ them in every case. Especially should he be careful to ascertain whether the swelling is transparent, not only on the first time of using the trocar, but also on each subsequent occasion on which he is called upon to puncture the swelling; and in making this examination he should be careful to press the swelling to the fore part of the scrotum between the fingers and thumb of one hand, so as to render the skin quite tense

* Professor Syme relates a case of "abdominal hydrocele" in a child æt. 4 or 5. The fluid was contained, not in the tunica vaginalis, but in an expansion of the cord. *British Medical Journal*, 1861, p. 139. The dissection of a similar case is given by Mr. Lister, in *Edinburgh Medical Journal*, September 1856.

over it, while he screens his eyes from the light with the other hand placed over the scrotum. In a doubtful case I place the patient upon a table near a window, and use as a screen, in addition to my hand, a dark cloth, carefully adjusted over the upper surface of the swelling and covering my head. These precautions are necessary to avoid error. Assistance may sometimes be gained by looking through a stethoscope or tube. Transparency is a pretty sure indication of the presence of serum or other light-coloured fluid, and is therefore a tolerably safe warrant for the use of the trocar. I have carefully examined hernia and other swellings for the purpose of ascertaining how far transparency may really be relied upon as an evidence of the presence of hydrocele or watery cyst in the scrotum, and have not found it to fail. That is to say, every swelling which has transmitted the light of a candle or the sun has proved to contain light-coloured fluid. Even in the hernia of young children, where the bowel and its coverings are thin, the light of a candle placed close to the part fails to shine through.

Though transparency is thus a most valuable positive indication, yet the negative evidence afforded by its absence is by no means equally conclusive that the swelling is not of the nature of hydrocele; for the admixture of a small quantity of blood with the fluid will entirely prevent the transmission of light; and a considerable increase of the thickness of the sac may have the same effect. Under these circumstances, the diagnosis is more difficult, and may perhaps not admit of being satisfactorily established without making a puncture with a grooved needle or a trocar, or an incision. Such a hydrocele, extending into the inguinal canal, so that its upper end cannot be defined with the finger, and so that it acquires an impulse from coughing, simulates hernia very closely. The history of the case, indicating whether the swelling commenced in the scrotum, and ascended to the groin, or in the groin, and descended to the scrotum, may assist in the diagnosis. The patient should be examined in bed, to ascertain whether the recumbent position causes a diminution of the swelling. In non-congenital hernia, moreover, the testicle may usually be felt at the lower part of the scrotum, which cannot often be done in ordinary hydrocele. In a doubtful case it would be more prudent to cut cautiously down to the part than thrust either a trocar or a grooved needle into it.

The two affections, hernia and hydrocele, are not unfrequently combined; and the hernial swelling may come into contact with the hydrocele, so as to communicate to it the impulse received in coughing. The nature of the case may usually be ascertained by

examining the patient in the recumbent position. The contiguity of the hernia need make no difference in the treatment of the hydrocele, for the inflammation excited in the latter by injections or other means is not likely to extend to the hernia. The hernia may not only reach the hydrocele, but may descend into the scrotum in front or behind the hydrocele, or on one side of it. Sometimes the hernial sac, with its contents, has projected into the hydrocele. Out of six cases of this kind which M. Dupuytren witnessed,* he only twice saw symptoms of strangulation resulting from constriction of the organs at the place where they were engaged in the serous pouch of the testicle.

The distinction of a non-transparent hydrocele from hæmatocele, cystic and other tumours of the testicle, is sometimes quite impossible without resorting to the aid of a trocar or an incision. An incision is usually to be preferred, because more information is obtained by it, and because, if the swelling turn out to be a hydrocele with thickened sac, a free incision, followed by suppuration, is, on the whole, the best treatment.†

Hydrocele appears on each of the two sides of the scrotum in about an equal number of cases, and is most frequent between the ages of thirty and fifty. It is also common in elderly persons.‡ It usually forms slowly, and is painless, being inconvenient only from its bulk and weight. In some cases, however, it is attended with a good deal of pain. I have observed this to be so when the fluid is re-accumulating after tapping more frequently than when it is collecting for the first time. Sometimes the hydrocele is a remnant of an acute inflammatory attack in the epididymis, or is an attendant upon inflammatory or other disease in the testicle. Under such circumstances lymph is usually mingled with the serum; and when the

* *Medical Gazette*, vol. xii. p. 686.

† The following case is an illustration of the difficulties occasionally met with in the diagnosis of hydrocele. A man, æt. forty-five, had swelling of the left testicle as large as a cocoa-nut, heavy as if it were solid, and with indistinct feeling of fluctuation; not the slightest transparency; slight constriction near the middle; large tortuous veins upon its fore part; the cord healthy. He said that twenty years ago he received a sabre-wound, which left the testicle about twice its natural size, and it remained so till October 19, 1860, when he had a blow, after which the part became swollen and painful. The swelling continued, and the case was supposed to be hæmatocele. Yet on November 2d a trocar gave vent to 12 ounces of the ordinary straw-coloured fluid of hydrocele, and the sac was found to be much thickened.

‡ It seems that other alterations in the tunica vaginalis are also common in advancing years. Dr. Duplay (*Archives générales de Médecine*, Août 1855, p. 132) gives an account of the examination of these parts in 59 persons, whose ages ranged from sixty to eighty-six. The tunica vaginalis was more or less altered in 44; in 12 it was thickened; in 17 there were adhesions; in 15 there was hydrocele; and in 4 cartilaginous or osseous bodies hanging by narrow pedicles.

disease subsides, the fluid is commonly absorbed, though the lymph often remains, and causes adhesions between the surfaces of the tunic.

Treatment. Although the morbid condition upon which the accumulation of the fluid depends must be of the faintest possible kind, yet we know of no means by which it can be arrested and the resorption of the fluid induced. All the measures we are in the habit of adopting with the view of checking secretion or promoting absorption are valueless, or nearly so, in this instance. Mercury and iodine, whether given internally or applied outwardly, vesicatories or pressure, however carefully employed, are almost invariably useless. The swelling slowly continues in spite of them; and if limited at all, is so only by the resistance of the surrounding tissues to further distension. In this respect, it is true, hydrocele is but an example of a class. In other diseases of the like kind—hydrocephalus, hydrothorax, hydrops articuli, &c.—the morbid change determining the accumulation of the fluid is slight, almost inappreciable, and the resistance to remedies is as great, or nearly as great, as in hydrocele.

Happily this feature is of no great importance in the cure of hydrocele; and we should not have much inducement to persevere with treatment of this sort, even if it were much more effectual than we know it to be, for the removal of the fluid by a trocar is so simple, quick, and painless a proceeding, that we do not hesitate to resort to it as soon as the swelling has become a source of inconvenience. An interspace between the veins should be selected where the sac is transparent. The lower and fore part is usually chosen; and the point of the instrument should be directed upwards to avoid wounding the testicle. There is no advantage in incising the skin with a lancet before introducing the trocar, or in placing any plaster or other dressing upon the wound afterwards. I have never known any bad result to follow the tapping, though my patients are often obliged to walk some miles to their homes immediately after the operation. That some risk, however, attends upon it is shown by cases in the practice of Sir A. Cooper, Mr. Curling, and others, where sloughing of the scrotum has followed, and has even proved fatal. In some instances effusion of blood into the sac, from a wounded vessel, forming a hæmatocele, has taken place.*

The relief afforded by tapping is, however, only temporary. The fluid is almost sure to collect again, and, in all probability, it will be necessary to repeat the operation in the course of a few months. The patient may be content with the relief afforded by periodical tappings, or may be unable to spare the time requisite for effecting a cure. Should this not be so, it is well at once to inject into the emptied sac, through the canula, some fluid which is calculated to excite smart inflammation of the tunic; it being found by experience that this will, in most cases, lead to a cure. Many fluids have been tried,—port-wine, solution of sulphate of zinc, &c.,—the mode of action of all being the same; and they, or the chief part of them, are allowed to return through the canula after a period varying from a few minutes to half-an-hour. The most convenient plan, and the one which, from the small proportion of failures, seems to deserve its present popularity, is to throw into the sac two, three, or more drachms of the tincture or some solution of iodine, and to allow it to remain. While the canula is being withdrawn.

* Mr. Davey (*British Medical Journal*, 1857, p. 593) relates that he tapped an enormous hydrocele, hardly smaller than the body of a robust child, and removed a washhand-basinful of serous fluid. His intention was to remove the contents by instalments, so he repeated the operation a few days after. This was followed by violent inflammation of the scrotum and contiguous parts, threatening general sloughing of the scrotum. Many and deep punctures were, however, made, followed by fomentation; the inflammation and swelling gradually subsided, and the hydrocele was cured.

after the injection, the sides of the sac should be nipped between the finger and thumb to prevent the escape of the iodine from the sac; and the scrotum may be shaken a little roughly so as to insure the contact of the fluid with all parts of the interior of the sac.*

The inflammation following the injection of a hydrocele is not confined to the tunica vaginalis, but extends to the cellular tissue and skin of the scrotum, and usually to the epididymis. I think iodine has the advantage over the other fluids just mentioned, in that the inflammation excited by it is more moderate and uniform in degree; it is rarely very severe, yet generally sufficient for the purpose. The patient had better rest in bed for a day or two, but need seldom be confined longer; and it is rarely necessary to resort to any additional measures for increasing the amount of inflammation, such as rubbing the sides of the sac together, or irritating the skin. The inflammation and swelling subside spontaneously. Some enlargement and hardness may remain for weeks, or even months, but it is usually of no consequence. We need not despair of a cure, though the inflammation be very slight; for in some cases, in which scarcely any pain or swelling followed the injection, the hydrocele has not returned. In some the fluid has re-collected, so that the part was in much the same condition as before the operation, and then has gradually been absorbed. It is well, therefore, to wait for a considerable period before resorting to any further treatment. The cure is usually permanent, though in a few instances the fluid has returned after a lapse of some years.

We learn by dissection that the inflammation consequent on the injection of iodine, or other stimulating fluid, for the cure of hydrocele, is attended commonly with the effusion of lymph upon the surface of the tunica vaginalis, and of fluid into the cavity of the tunic. The fluid is tinged with blood; hence, if the part be examined a few days after the injection, though there may be a good deal of fluid in the sac, it will seldom be found translucent. Subsequently, as the fluid becomes absorbed, the opposed surfaces of the tunic come into contact, and are, more or less, united by lymph. The adhesion may be general, so that the cavity is quite obliterated, or filled up by the fine areolar tissue into which the lymph, in course of time, becomes converted; or the adhesion may be partial, leaving spaces in which fluid may still collect; or it may be confined to a few bands or threads connecting the surfaces. Lastly, the lymph may be in such small quantities, or may be so nearly absorbed, as to leave the membrane pretty much in a natural state. This has been found in some cases in which the hydrocele has been cured; so that it would seem the mere passing of inflammation upon the membrane may induce such a change in it as to prevent the reaccumulation of the fluid.† Very rarely does the inflammation proceed to suppuration. Sir B. Brodie has known it to do so in three cases, and Mr. Curling in one.

* Mr. Davey (*British Med. Journal*, March 15, 1862) appears to attribute his success in the treatment of numerous cases of hydrocele in Ceylon, with an injection of sulphate of zinc (2 grs. to 1 dr.), to his being in the habit of kneading the scrotum for a minute or two, so as to bring the zinc with some force into contact with the whole interior of the sac.

In the same journal (February 22, 1862) is the account of a case of hydrocele in an elderly man tapped and injected with three drachms of turpentine. More inflammatory action than necessary followed, with suppuration in the scrotum, and a cure.

Now and then the mere rubbing together of the surfaces of the tunica vaginalis, after the complete evacuation of the fluid, has been followed by sufficient inflammation to effect a cure. This simple method, however, will not often succeed.

† In sixteen cases successfully treated in various ways, M. Hutin found the cavity of the tunica vaginalis quite obliterated in eight; the adhesions of its surfaces were only partial in four, and in four there were no traces of them. *Arch. Gén. de Méd.* cinq. série, tom. ii. p. 218.

Although ill effects rarely follow the injection of hydrocele, it is not worth while to run the risk of exciting inflammation in a very large sac; when, therefore, the fluid exceeds a pint, it is advisable simply to tap the sac, and, on a subsequent occasion, again to draw off the serum before so large an accumulation has taken place. The injection may then be resorted to with comparative safety.

The presence of some disease in the testicle, even though it be the cause of the hydrocele, does not necessarily constitute an objection to tapping; indeed, much relief may sometimes be given by drawing off the water. It is not, however, advisable to inject the sac under these circumstances; *first*, because the inflammation so caused is likely to aggravate the disease in the testicle; and, *secondly*, if the disease in the testicle subsides, the hydrocele commonly disappears spontaneously. Occasionally, after tapping a hydrocele, we find the testicle somewhat enlarged and indurated, in consequence of chronic inflammation, which has taken place in the body of the gland, or in the epididymis; and the question arises whether this constitutes an objection to the radical treatment of the hydrocele. If the enlargement be considerable, the part tender, and the hydrocele recent, the proper practice is to wait for a time, and, under appropriate treatment for the disease of the testicle, the enlargement and the hydrocele will probably disappear altogether; but if the hydrocele be of some standing, and the affection of the testicle slight, there is no objection to injecting the sac.

Acupuncture causes a temporary diminution of the swelling, the fluid passing through the openings made by the needle into the areolar tissue of the scrotum, where it is absorbed. It is not to be relied on as a means of cure, for the fluid usually re-collects as soon as the punctures in the sac have healed, though it is thought to do so less quickly than when the trocar has been used.

In several instances I have tried the plan of inserting a little *nitric oxide* of mercury upon a moistened probe passed through the canula, after the fluid had been evacuated. It commends itself by the facility with which it is done, and it is very successful. The inflammation which it excites is, however, more severe than that caused by iodine; and in two cases in my own practice this treatment was followed by salivation. I have therefore ceased to adopt it. I have found the wire seton open to the objection made to it by others, viz. that it is liable to be followed by troublesome suppuration.*

An incision into the sac, the wound being kept open so as to cause suppuration, is an effectual method, though unnecessarily severe for ordinary cases. It confines the patient to bed for some time, and is not altogether unattended with danger. The inflammation which follows is sometimes very acute, and accompanied by a good deal of constitutional disturbance. In Guy's Museum is a specimen of tunica vaginalis said to have sloughed away under these circumstances. The procedure is suited to the cases in which the sac is thickened, and in which an exploratory incision is required to ascertain the real nature of the disease; also to cases in which milder means have failed. In two of the instances in which I have resorted to it, plugging and inflammation of the veins of the lower limb ensued, but were productive of no permanent ill effect.†

Spontaneous cure, though common in infants, is very rare in after-life; so rare that the prospect of it is not worth taking into account. It has hap-

* See Dr. Gillespie, *Ed. Medical Journal*, January 1862. The conclusion to which I arrived at from a paper and discussion at the Edinburgh Medico-Chir. Society is that the effects of the wire seton are very uncertain. In some cases little or no inflammation is induced, in others severe suppuration. *Ed. Medical Journal*, vol. vii. p. 1074.

† For an account of other modes of treatment, see Curling on *Diseases of the Testis*.

pened from a blow,* or a violent effort in coughing, and during a fit of the gout, from inflammation of the tunica vaginalis, and, gradually, without any apparent cause.†

Infantile hydrocele is very common. It generally takes place after the communication with the peritoneal cavity has been obliterated, but may appear before. It is easily recognised, owing to the thinness of the coverings giving ready transmission to light. It usually subsides spontaneously, and needs, consequently, little attention. The cure may perhaps be quickened by stimulating the skin with iodine or zinc lotion, or by puncturing the sac with a needle in two or three places. In considering the advisability of any more active treatment the probability of a communication with the abdominal cavity is to be borne in mind (p. 550).‡

ENCYSTED HYDROCELE.

Cysts are very often found in connexion with the testicle; and a good deal of pathological and practical interest attaches to them. They have received the careful attention of able Anatomists and Surgeons, and have been the subjects of several essays,§ and are numerous displayed in our museums; but their origin and nature still remain to be clearly made out.

They may most conveniently, if not most correctly, be thrown into two groups—the *small* cysts and the *large*. Those included in the former group seldom or never attain to greater size than a pea, are of very simple nature, commonly do not attract attention during life, and do not require treatment; whereas those in the second group may attain to indefinite magnitude, and become, therefore, objects for diagnosis and treatment. Some of these are also less simple in their nature and contents.

* Pott's Works, by Earle, vol. ii. p. 292. In other cases, where the swelling has disappeared after a blow, and the patient has thought himself cured, he has been disappointed by the return of the fluid.

† Brodie, in *Medical Gazette*, vol. xiii. p. 90.

‡ Dr. Linhart (*Frorieps Notizen*, 1856, vol. ii. No. 4; and *Brit. and For. Med. Rev.* July 1856) recommends in such cases subcutaneous incision of the tunica vaginalis, which allows the fluid to become effused into the scrotum, where it is rapidly absorbed. M. Richard (*Gazette des Hôpitaux*, 1857, No. 41, and *B. and F. Med. Rev.*, July 1857) removes the fluid with a very small trocar, and then injects a small quantity of alcohol, an assistant compressing the track of the inguinal canal for a minute or two, experience having shown that the persistence of the communication with the abdomen is not of the importance that might have been expected.

§ Brodie, in *Medical Gazette*, vol. xiii. p. 137. Gosselin and Duplay, *Archives générales de Médecine*, 4^e série, tome xvi. pp. 24 and 163; and 5^e série, tome vi. p. 139. Liston, Lloyd, and Paget, *Medico-Chirurg. Trans.* vols. xxvi. and xxvii. Luschka, *Virchow's Archiv*, vol. vi. p. 310. Curling, *Diseases of the Testis*, p. 130, &c.

The *small cysts* are found in as many as a half of the testicles examined after the age of forty. They are rarely met with before puberty. They lie immediately beneath the serous coat of the epididymis more frequently than on the body of the testicle. When they occur upon the latter, they are situated between the tunica vaginalis and the tunica albuginea; when on the epididymis, they are situated, apparently, between the tunica vaginalis and the proper investing fibrous coat of the part. Thus they seem to be related rather to the serous or subserous tissue than to the organ itself. They may be dissected clean out without interfering with the tubular structure; and no communication can be shown to exist between them and the tubules. Each has a proper fibrous tunic of its own, and contains clear fluid, in which are simply granules and epithelial scales, with occasionally small crystals, never spermatozoa or other spermatic elements. They may be single or in numbers. Sometimes they appear as mere points beneath the membrane; sometimes they cause slight elevations of it; and sometimes they project it till they acquire a polypose form, and hang into the cavity of the tunica vaginalis. Their pedicles may become long and narrow, and may even give way, leaving the cyst free in the cavity. Possibly the small fibrous, cartilaginous, and calcareous bodies occasionally found in the cavity of the tunica vaginalis originate in these small cysts, which have become detached, and have solidified and undergone other changes while lying loose in the cavity. Sometimes they burst, and, after having discharged their contents into the cavity, shrivel and are converted into small solid remnants. It is possible that the irritation occasioned by them may sometimes give rise to hydrocele. With this exception they are not productive of any symptoms or inconvenience, and do not come under the notice of the Surgeon.

The *large cysts* are less common than the preceding, and are not limited in their size, having been known to contain twenty, and even forty, ounces. They are composed of a fibrous tunic, lined by delicate tessellated epithelium. Some of them contain only serous fluid, much resembling that of common hydrocele. In many of them, however, the fluid is paler than serum, more like water; or whitish, milky, not quite transparent. It then gives little or no evidence of albumen when it is heated; and when it is placed under the microscope it shows spermatozoa and spermatic cells in greater or less quantity. When the fluid is fresh, the spermatozoa are often lively in their movements, and have been sometimes found to be abundant in the fluid removed from the cyst, although they existed

scantily, or not at all, in the tubules of the testis and of the epididymis. The presence or absence of spermatozoa may usually be determined by the character of the fluid, whether it be watery or serous. Accordingly, on tapping a hydrocele, if the fluid evacuated be watery or milky, we may be pretty sure that it is of spermatic character, and that it was contained, not in the cavity of the tunica vaginalis, but in a cyst. We read, it is true, now and then, of spermatic fluid being withdrawn from the cavity of the tunica vaginalis, and it is possible that it may be so. The fact, however, has seldom been proved by dissection. The only instance of the kind that I am acquainted with is one described by Luschka; and the presence of the spermatozoa in the hydrocelic fluid was, in that case, shown to be due to the bursting of a cyst into the cavity of the tunica vaginalis.

Spermatozoa, then, with very rare exceptions, are peculiar to encysted hydrocele, but are not present in all cases of that disease. The question arises, what relation do they bear to the containing cysts? Is their presence merely accidental, consequent on a communication being formed between the cyst and one of the tubes of the epididymis by rupture of the latter from blow or other cause. This view is taken by some pathologists. We must bear in mind, however, that such communications between secreting and other tubes with cysts, abscesses, or other sacs formed in their neighbourhood, very rarely occur. Certainly, our experience of such a process in other parts of the body does not warrant our looking to it for the explanation of so common an occurrence as the presence of spermatozoa in encysted hydrocele. Moreover, the other characters of the fluid (the absence of albumen, &c.) in these cases indicate that it is *sui generis*, and not a mere resultant of the addition of sperm to the fluid of an ordinary cyst. Mr. Paget takes the view that the spermatic contents are a product of the cyst itself, and thinks that cysts seated near the organ, which naturally secretes the material for semen, may possess a power of secreting a similar fluid. To this, however, must be objected the improbability that so exact an imitation of a complex and highly wrought secretion should take place in a cyst developed merely in areolar tissue, and unconnected with the secreting tissue of the gland. It is difficult to believe in such an approach to the spontaneous generation of spermatozoa after the developmental energies of embryonic life have passed away. One cannot help suspecting that the spermatic corpuscles of these cysts are the offspring of the spermatic corpuscles of the proper secreting tubes, and that the cysts themselves are, in some

way or other, offshoots from those tubes. Luschka observed distinct communication between the spermatic tubes and the cysts in each of the cases examined by him; the opening of the tubes into the cysts being large enough to admit a bristle, and to permit mercury to pass from the tubes into the cysts, or *vice versâ*. Similar communications have been found by Curling and others. In other instances, however, equally careful observers have failed to discover any communication of the sort, or, indeed, any connexion between the cysts and the tubules. They describe the cysts as possessing complete capsules of their own, invested all round by areolar tissue, which separated them from surrounding structures and permitted them to be dissected away without any injury to those structures. It is quite possible that, in such instances, the cysts may have originated in the tubes and have lost their connexion with them as growth went on. For the present, however, the question of the real origin of these sperm-bearing cysts must remain an open one.

They are usually found in or near the epididymis, so near that they may fairly be presumed to have originated in it.* Sometimes two or more coexist; and sometimes the whole epididymis is occupied by, or transformed into, a mass of cysts. Occasionally the spermatic cysts are associated with common hydrocele,† or with cysts which contain mere serous fluid. The latter are not always so closely connected with the epididymis as the former.

In a few instances large cysts have been found upon the tunica albuginea testis, between it and the visceral layer of the tunica vaginalis, or in the substance of the tunica albuginea; but I am not aware that spermatozoa have been detected in the cysts so situated.‡

Diagnosis. Encysted hydrocele corresponds in its general features with ordinary hydrocele, being a light, fluctuating, transparent

* This position has suggested that they may originate in some of the tubes of the Wolffian body, which have not become connected with the testicle, and which, therefore, remain as blind canals or sacs. Virchow, *Die Krankhaften Geschwülste*, p. 282. This pathologist believes that, after a time, they may lose their spermatic character and become simple serous cysts.

† "I tapped the lower hydrocele, and a yellow serous fluid was discharged; but still half the swelling remained. I then darkened the room, ordered a candle, and examined the swelling, which extended from the upper part of the testis to the abdominal ring. It was very transparent: I therefore tapped it, and drew off a fluid like water, quite free from colour, which contained some coagulable matter, but less than common serum." Sir A. Cooper, *On the Testis*, p. 170. This was probably a spermatic cyst, and such cases are not very uncommon.

‡ In *Trans. of Path. Soc.* vol. vii. p. 247, is the dissection, by Mr. Hutchinson, of "a thick-walled cyst, size of a goose's egg, developed in the layers of the tunica albuginea, and by which the gland-structure itself had been displaced downwards."

swelling, connected with the testicle. It differs from ordinary hydrocele in its relation to the testicle, being situated above or below it, or to one side, instead of enveloping it. Sometimes the cyst may be felt quite distinct from the organ, giving the impression of an additional testicle. As the cyst increases, the testicle is borne upon its wall and may still often be recognised as a distinct substance, perhaps, quite at the lower part of the swelling, more rarely on one side, above, or in front. This projection of the testicle may be the only means of distinguishing an encysted from an ordinary hydrocele; and it is by no means a sure one, for we sometimes find the same thing in common hydrocele, owing to adhesions or other cause. Sometimes the cyst projects into the sac of the tunica vaginalis, distending it in the same manner as if the fluid were contained in the cavity. Then, and under some other circumstances, it is impossible to tell whether the fluid be in a cyst or not; and it is no uncommon thing for the Surgeon to be first informed of the nature of the case on finding the fluid evacuated by his trocar to be of the watery nature of encysted hydrocele instead of being the serous fluid of ordinary hydrocele.

Treatment. Happily the diagnosis between common and encysted hydrocele is not very important; for the treatment of the two is the same. The fluid should be evacuated when its quantity is such as to be a source of annoyance; and the sac may be injected with iodine. The prospect of a radical cure is not so good in encysted as in common hydrocele; but success has followed in a sufficient number of cases to encourage the adoption of this plan, and even to justify its repetition should the first trial fail. I am not aware that any ill consequences have ensued upon it. The palliative treatment of merely drawing off the fluid has this recommendation, that the fluid does not usually re-collect in the cyst as quickly as in common hydrocele. It should be observed that these cysts sometimes attain to a certain size, and then remain stationary for years; so that, unless they are increasing inconveniently, they may be left alone.

Hydrocele of the spermatic cord consists in the accumulation of fluid, which is usually of serous character, in a bag in some part of the spermatic cord. It may be near the testicle, or near the internal ring, or at any intermediate point. It rarely attains to a larger size than that of a hen's egg. The bag is thin, and probably consists, in most instances, of an unobliterated portion of the canal of the tunica vaginalis, which has become distended by an accumulation of fluid in it. This view is entertained by most Surgeons; and is supported by the fact that unobliterated portions of this canal may not uncommonly be discovered, by dissection, in young persons and in adults. The hydrocele is usually oblong, its long axis corresponding with that of the cord; it is surrounded by the loose areolar tissue of the cord, which admits of its being easily dissected away. Some-

times, probably, an independent cyst is formed, constituting *encysted hydrocele of the cord*; but the two conditions are not distinguishable from one another during life, even if they be on careful dissection. They need not, therefore, be considered separately.*

Diagnosis. The sac and its contents are commonly transparent. This may be ascertained by fixing the sac in a particular position, stretching the skin tightly over it, and adjusting the light carefully; and it is often the only means of distinguishing the disease from hernia and other swellings. When the sac is situated below the external ring, and can be felt as an oval, defined, fluctuating swelling, there is no difficulty. But when the sac is higher, and, in consequence of the laxity of the investing tissues, can be slipped to and fro in the inguinal canal, ascending in the recumbent, and descending in the erect posture, and acquiring an impulse from coughing, its nature can be recognised with certainty only by its transparency.

The following cases indicate some of the points of difficulty in the diagnosis of this affection:

A man, æt. thirty-five, had swelling above the right testicle (which was rather indurated) extending along the cord, through the inguinal canal, to the abdomen. It felt like a hernia, and received a distinct impulse when the patient coughed. It did not, however, diminish in the recumbent position; it was said to have followed a blow upon the pommel of a saddle; and, when examined by the aid of a candle, it was found to be transparent. I introduced a trocar and drew off six ounces of straw-coloured fluid. The swelling partially returned, but subsided under the external application of iodine, and there was no trace of it two years afterwards.

Compound spermatic cyst. A youth, æt. nineteen, had a swelling on the right side of the scrotum, closely connected with the upper and fore part of testicle. Fluctuation could be perceived in it, and transparency when the skin was stretched tightly over it. Above this, at the external ring, was a small soft swelling, doughy, not distinctly fluctuating. Like a hernia it went up into the abdomen, quite out of reach, when he was laid down, and returned again when he stood up or coughed. It also communicated an impulse to the finger when he coughed. He wore a truss, which had been ordered by an experienced Surgeon at a hospital; and it was thought to be a case of hernia by most of those who examined it at our hospital. I was induced to examine more carefully by observing that the impulse was less distinct than it usually is in hernia. Moreover, when he stood and coughed, the swelling seemed to bolt past my finger and thumb, which, with a little pressure, met together above it; and I thought I could press it to and fro, as though it were a distinct cyst or tumour and not a swelling prolonged into the abdomen. When he was laid, and the swelling had disappeared, it could be brought into view, and even brought beyond the external ring, by traction upon the cord. When thus pulled down, with the skin drawn tightly over it, the light of a candle could be seen through it. I accordingly cut down carefully through the cre-

* Mr. Gamgee examined, in the Pathological Museum of the University of Pisa, the calcified cyst of a hydrocele of the human spermatic cord of about the shape and size of a hen's egg. *Surgical Researches*, p. 193. In several instances blood has been found in the cysts of the cord.

master, which was unusually distinct, and the other coverings, and exposed a sac, in which we could perceive that there were membranous contents capable of being moved about, and we could see vessels upon them. They looked and felt like omentum or intestine in a hernial sac. I again had recourse to the candle, and, finding that the swelling was quite transparent, and that its contents could not be returned into the abdomen while the cord was fixed, I opened the sac, giving vent to some clear fluid, and exposed several thin-walled cysts, bearing vessels, and containing clear fluid. Some were as large as a bean, the others were smaller. They were connected together and with the upper part of the cyst which proved to be a closed sac unconnected with the abdomen. I cut away the mass of cysts with a portion of the containing sac; and then opened the lower and larger swelling which appeared to be formed by a portion of the tunica vaginalis distended with fluid. Suppuration ensued, the wound healed up, and the lad recovered.

Hydrocele of a hernial sac containing omentum. A man, æt. fifty, was the subject of supposed incarcerated hernia. He had suffered from rupture many years; used to return it when it descended, and perceived a gurgling in doing so; had worn a truss. A week previously to my seeing him it came down and was painful; and as he could not return it, he applied to a Surgeon, who made many ineffectual attempts to reduce it and, failing, kept him in bed on low diet. The swelling presented the appearance of an inguinal hernia, was larger than a goose's egg, with a narrow neck extending up the inguinal canal, so narrow that I thought it could scarcely be traversed by intestine. Accordingly, I examined the swelling with a candle, and found it transparent. There being no urgent symptoms, I directed the patient to get up and take some aperient medicine and his usual diet. A fortnight after, the swelling remaining the same, I introduced a trocar and drew off four ounces of straw-coloured fluid. There remained in the sac a long firm substance extending up the inguinal canal and feeling like a piece of omentum. The fluid re-accumulated, and the swelling was a source of great annoyance; so I made an incision into it. It proved to be a hernial sac containing a strip of omentum and four ounces of serous fluid. There was no communication with the abdominal cavity. The sac was left open, suppuration ensued, and the man quite recovered.

Transparent swelling in and near the inguinal canal proving to be abscess. A young woman had a fluctuating swelling, as large as a turkey's egg, over the region of the right external inguinal ring, extending towards the pubes in the one direction, and along the course of the inguinal canal in the other. It was seen to be transparent when examined with a candle, and was thought possibly to be a cyst or collection of fluid in the canal of Nuck. It had commenced two years previously, was gradually increasing, and was a source of much inconvenience. I made a careful incision into it, and gave vent to a quantity of serum, followed by thin pus and masses of soft white lymph. It was evident that the pus-corpuscles and the lymph had subsided to the bottom of the abscess, as the patient lay in bed, and had left the exposed part full of serum only and, therefore, transparent. A free vent was given to the pus; gradually the discharge ceased, and the part healed.

The *diffused hydrocele of the spermatic cord* described by Pott and Scarpa, and appearing to consist in a simple and local œdema of the cord, I have never seen; nor can I make out that any cases of the kind have fallen under the observation of modern Surgeons. At any rate it is a very rare affection; and it is sufficient to refer to the account of it given by the authors just mentioned.*

* Pott, "On the Hydrocele of the Cells of the Tunica Communis," in his *Chirurgical Works*, by Earle, vol. ii. p. 224. Scarpa, "Sull' Idrocele del Cordone Sper-

HÆMATOCELE

consists in an effusion of blood, either into the cavity of the tunica vaginalis, or into a cyst connected with the testicle or the cord. We have, therefore, "hæmatocele of the tunica vaginalis," "encysted hæmatocele of the testis," and "hæmatocele of the spermatic cord." It is usually caused by a blow, and not unfrequently supervenes upon hydrocele, common or encysted. The source of the blood, in such case, is some ruptured vessel or vessels in the tunica vaginalis, or a small wound penetrating the tunica vaginalis.* It may also follow a wound of a vessel caused by the trocar in tapping a hydrocele. The quantity and condition of the blood vary a good deal. Sometimes there is only sufficient to tinge the fluid, and to deprive it of its transparency. Oftener there are clots mingled with the fluid; sometimes it is pure blood. Occasionally the coagula are arranged in layers, as in an aneurismal sac;† and the blood may be in various stages of degeneration.

In hydrocele, as has been remarked before (p. 548), the containing tunic usually retains its tenuity and its transparency for a long time and, perhaps, never alters. This is not so in hæmatocele. An early effect of the presence of the blood is to cause some inflammation and thickening of the tunic, whether it be the tunica vaginalis or the wall of a cyst. This thickening often proceeds to a considerable extent, amounting, it may be, to nearly an inch, and sometimes affects the surrounding areolar tissue, which becomes condensed and adherent to the tunic. In hæmatocele of the tunica vaginalis the thickening affects the visceral as well as the reflected portion of the tunic, and may extend to the tunica albuginea; but the substance of the testicle remains healthy, unless indeed it be subjected to atrophy in consequence of the pressure exerted upon it by the blood or by the contraction of the thickened tunics.

matico," in his *Opusculi di Chirurgia*, vol. i. p. 137. Mr. Flower (*Med. Times and Gaz.* vol. xvii. p. 109) describes a case of diffused hydrocele, below the testis, of the gubernaculum testis; the testicle was retained in the inguinal canal.

* "A man was brought into Guy's Hospital who had long had a hydrocele, and had received a severe blow upon it, which suddenly increased the swelling, bruised the scrotum, and produced great pain from distension. I immediately made an incision into it, and discharged a large quantity of water and coagulated blood; and found a rent in the tunica vaginalis between one and two inches in length, and covered with a coagulum." Sir A. Cooper, *On the Testis*, p. 212. In a case where hydrocele was converted into hæmatocele by a blow from a hammer Mr. Walter (*Brit. Med. Journal*, 1857, p. 524) found a rent in the tunica vaginalis, near the raphe, admitting the finger, and a ruptured artery from which the bleeding had proceeded.

† In the account of a specimen of this kind in Guy's Museum the patient is said to have had enlarged testicle from childhood.

Lymph also may be effused upon the internal surface of the tunica vaginalis and be, there, mingled with the clotted blood.

Diagnosis. When the testicle becomes quickly swollen after a blow, the swelling not being caused by inflammation, which may usually be ascertained, there is probably hæmatocele. Or if a hydrocele suddenly enlarges and loses its transparency, there is probably an effusion of blood in its cavity. The probability is, in either case, increased by the presence of ecchymosis in the scrotum. But when the affection is more chronic, and when the ecchymosis, if it have existed, has passed away and been forgotten, the diagnosis is more difficult, and must be based upon a consideration of various circumstances, such as the degree of rapidity with which the swelling took place, the distinctness of fluctuation, and the history. None of these, however, are certain guides; and the records of surgery contain numerous instances of mistake under able hands,—hæmatoceles removed for malignant disease, and malignant testes opened for hæmatocele, &c. Assistance may be derived from observing carefully the rate of increase from time to time. In cancer it usually goes on steadily; but in hæmatocele it is often irregular. Sometimes the hæmatocele ceases to enlarge, or even diminishes in size; and this seldom or never takes place in cancer.

Treatment. In ordinary cases of hæmatocele, especially when the affection is clearly attributable to a blow, the hæmorrhage ceases after a time, the inflammation excited by it subsides, and the blood becomes slowly absorbed, the process occupying perhaps a long time, and being marked by the same stages as when blood is effused in other parts. Our first efforts, therefore, in the treatment of hæmatocele are to assuage the vascular activity and the inflammatory condition by rest in the recumbent position, with the scrotum elevated; by the local abstraction of blood by means of leeches placed above the scrotum; and by cold or warm applications, according to the comfort afforded by them. After the pain has been relieved and the heat of the part reduced, the patient may move about, with a suspensory bandage, and leave it to time to effect the remainder of the cure. Even when hæmatocele supervenes upon hydrocele the same treatment should be employed; and the gradual cure of both has, in some instances, followed, without any further surgical interference.

It sometimes happens, however, from causes which we cannot quite explain, that the hæmorrhage continues; and the swelling, consequently, increases till it may contain some pounds of blood, the pain attendant upon it being proportionate to the rate at which it enlarges. The treatment mentioned in the last paragraph failing, a good-sized trocar should be introduced. If the blood is fluid, which it is sometimes found to be in these cases, great relief will often be afforded by its evacuation; and the diminution of the distension may be followed by a cessation of the hæmorrhage; so that if the swelling returns, and a second tapping is required, the fluid will be thinner and more serous than on the first occasion. Should the accumulation continue, the case may be treated with injection of iodine, as in the case of simple hydrocele. The admixture of a certain quantity of blood with the fluid evacuated does not much lessen the prospect of success from that treatment. Sometimes, however, the blood is so far solidified that the trocar is

of little avail. It may then be necessary to lay open the sac freely, to turn out the clots, and wash out the cavity by means of a syringe. The wound should be left open, to prevent further hæmorrhage, and to permit an easy vent for the products of inflammation; suppuration and granulation will take place, and a cure may thus be effected. This proceeding is not unattended with danger; and, if the patient be advanced in life, it is safer to remove the entire mass with the testicle. This, however, is rarely necessary in young or middle-aged persons. One of the sources of danger is further hæmorrhage from the tunica vaginalis, which has been known to take place profusely after the cavity has been laid open; or there may be severe and extensive inflammation, followed by sloughing of the tunica vaginalis and the tissue of the scrotum, with attendant fever and constitutional depression, which may prove fatal.* In some cases part of the thickened tunica vaginalis has been cut away with good result.† It has been said that when hæmatocele occurs spontaneously, it is more difficult of cure; but it is almost impossible to decide that the affection is really spontaneous, and not traumatic. Certainly the testicle ought not to be sacrificed, as would seem to have been done,‡ on the supposition that the affection was spontaneous.

The position of the testicle, under ordinary circumstances, is the same as in hydrocele; though I have observed that it varies more than it does in hydrocele. The gland is, therefore, commonly avoided by making the incision into the fore part of the swelling. In two cases mentioned by Mr. Curling there was inversion, the testicle being situated in front; and it was cut into in each. This led to its removal in one case. It is well, therefore, before using the knife or trocar, to endeavour to ascertain the position of the gland, by tracing the vas deferens and cord downwards and making out whether they run to the anterior or to the hinder surface of the swelling; also by information derived from the sensations of the patient when pressure is made upon various parts. Obviously it must often be impossible to assure oneself upon the point.

Encysted hæmatocele. Pathological collections present examples of cysts, both in contact with the testicle and in the spermatic cord, which contain blood; and cases of the kind are, now and then, met with in practice. They are not easy of diagnosis, the feature by which a cyst is most surely recognised—the transparency—being absent; and they are, consequently, liable to be mistaken for solid tumours, or for herniæ. The defined round or oblong shape, the fluctuation, the connexion with the cord, and the capability of being

* Mr. Curling (*On the Diseases of the Testis*, p. 197) was summoned "to a gentleman, æt. 79, on account of an attack of retention of urine from enlargement of the prostate gland. He had also, on the left side, a chronic vaginal hæmatocele, which had attained so large a size as to interfere with the introduction of the catheter. The tumour reached half-way down the thighs, and the penis was so completely buried in it that I was unable to reach the glans at the navel-like orifice in the integuments, to pass the catheter. I had no alternative, therefore, but to lay open the hæmatocele, from which three pints of dark grumous blood were discharged. The thickening of the sac prevented its collapsing after the incision. The patient died a week afterwards."

Sir B. Brodie does not recommend the negative treatment when the hæmatocele is of large size. Some artificial means should be resorted to for getting rid of it: first, because of its inconvenient bulk; and, secondly, because the pressure upon the testicle will disorganise, and in fact destroy, that organ. He found it to have been so in two cases dissected by him. *Med. Gazette*, vol. xiii. p. 380.

† Cooper's *Surgical Dictionary*, 8th ed., by Lane, art. Hæmatocele.

‡ *Lancet*, 1860, vol. i. p. 191.

moved by traction made upon it, as in the case related at page 562, and the history, may assist in leading to a correct opinion. Mr. Curling mentions a case in which 24 oz. of dark grumous blood were drawn by a trocar from an encysted hæmatocele.*

FIBROUS AND CARTILAGINOUS BODIES IN THE CAVITY OF THE TUNICA VAGINALIS.

At the upper end of the testicle, or about the line of junction of the testicle with the epididymis, may usually be seen a small soft fibrous body projecting into the cavity of the tunica vaginalis and covered by the serous coat of the cavity. It may be a mere granule, or it may be a polypose, membranous substance of considerable size. So far as I have seen, it is relatively as large in young subjects as in older persons; that is, it does not seem disposed to grow disproportionately to the rest of the organ, and it is doubtful whether it even keeps pace with it. It is probably connected with the mode of development of the testicle, consisting, perhaps, of some of the more or less atrophied tubes of the Wolffian body, which have not become united with the gland, or a remnant of the thread or duct which descended from the testicle in the fœtus; and it would not deserve a notice in this place were it not sometimes mistaken for a tubercle or other morbid product. Moreover, as has been before mentioned, small cysts are occasionally found in it; and these, hanging pendulous into the cavity, may be a source of irritation to the tunic. There are also sometimes developed, at or near the same spot, small solid excrescences, at first warty, afterwards leaf-like and pendulous, which, like the cysts just mentioned, may be a source of irritation and may lead to the formation of hydrocele.

Small *loose* bodies are also occasionally found in the cavity. They are commonly spherical, or nearly so, and are composed of laminæ of toughish fibrous, or fibro-cartilaginous, structure, with earthy matter at the middle. Their origin is involved in some obscurity in common with that of other bodies of the like kind, such as loose cartilages in joints and bursæ, phleboliths, &c. Probably they originate sometimes in the small fibrous processes just mentioned, or in cysts developed in them. These, increasing in size, becoming pedunculated, and then detached by giving way of the pedicle, and solidifying, might give rise to the bodies in question. This view

* In the Sydenham Society's *Year-book of Surgery*, 1861, p. 312, is quoted a case of hæmatocele of the tunica vaginalis, which ascended through the inguinal canal into the cavity of the abdomen. The treatment consisted in repeated tappings and injections of iodine.

derives confirmation from a case examined by Duplay:* one cartilaginous body was loose in the cavity, and another was attached by a filiform pedicle to the head of the epididymis. They are sometimes found in hydroceles. In a patient who used to suffer excessive pain as soon as the operation of drawing off the water was over, lying down on the floor and groaning with agony for a quarter of an hour, Sir B. Brodie found a loose cartilage after death in the cavity of the tunica vaginalis. They may be recognised during life, and removed by an incision if they are a source of annoyance. Often they do not attract attention and are discovered accidentally. Lately, in examining the hydrocele of a man, æt. about fifty, which had recently been tapped, and which was rather flaccid from the fluid not having fully re-accumulated, I felt a firm smooth body slipping about in the cavity. I, accordingly, made a small incision and extracted a disc as large as a bean, polished on the exterior, and composed of compact fibrous layers encircling an earthy nucleus. Hæmatocele ensued, with intense pain, rendering it necessary to lay open the cavity fully. This hydrocele was of six months' duration, and had been twice tapped without there being any unusual pain or other symptom indicating the presence of a foreign body.

Other alterations in the tunica vaginalis, such as thickening and calcification, do not often occur, except in conjunction with hydrocele or hæmatocele.

INFLAMMATION OF THE TESTICLE.

Under this head I propose to consider three affections: first, *acute inflammation*; secondly, *chronic inflammation*, including *syphilitic* disease; and thirdly, *scrofulous inflammation*. These are sufficiently distinct in their pathology, symptoms, and treatment to be discussed separately.

Acute inflammation is, comparatively, rare in the body of the testicle, but is very frequent in the epididymis. This is, probably, owing to the difference in the physical conditions of the two parts; the one being enclosed in a dense unyielding tunic which does

* *Archives générales de Médecine*, 1855, vol. ii. p. 133. In the Museum at Fort Pitt, Chatham, is "a small pedunculated body of an ossific nature attached to the vaginal tunic covering the globus minor." In pl. xiii. fig. 2 of Sir A. Cooper's work, a cartilaginous body is represented hanging from the caput epididymis by its pedicle. Sir A. Cooper has also seen one of these little bodies pendulous from the internal surface of a cyst between the tunica vaginalis and the tunica albuginea. He never detected them in the living body.

not permit the phenomena of inflammation readily to take place; whereas the structure of the other is less compact and less supported by membranous investment. When the inflammation attacks the body of the testicle, the affection is called "orchitis;" when it attacks the epididymis it is called "epididymitis," though the old term "hernia humoralis" is still often applied it.

Acute orchitis may be caused by a blow or a wound; but is most frequently seen during the occurrence, or rather during the subsidence, of mumps. It occurs in about one in forty or fifty of the sufferers from that malady; most often in those who are about the age of puberty. It begins usually on the fifth or sixth day of the affection, commonly in one testicle, sometimes in both. The glandular part of the testicle is more often involved than the epididymis; but the inflammation may commence in either part, and extend to the other. It reaches its height in four or six days, and then gradually subsides. It very rarely proceeds to suppuration, or any other structural change, or leaves any impairment of the organ. Now and then, however, it is followed by atrophy. Neither Sir A. Cooper nor Mr. Curling have met with this in their practice. Dr. Hamilton saw it in two cases; M. Rilliet in one.* I was lately consulted by a gentleman who attributed the wasting of one testicle to an attack of inflammation, during mumps, when he was a boy. The organ was almost gone, the vas deferens terminating only in a small lump which was tender. Although both testicles are sometimes inflamed in mumps, I am not aware of any instance in which atrophy has followed in both. The possibility, however, of this sequence in both organs, and its occasional occurrence in one, should induce us not to neglect the ordinary means of mitigating the inflammation when it supervenes, such as rest, cooling lotions, and saline aperients. It is not necessary, or wise, to resort to more active measures, unless the inflammation be very severe.

* Dr. Hamilton, in *Trans. of Royal Society of Edinburgh*, gives an account of epidemics of mumps in Lynn, which appear to have been very severe, in 1758 and 1761. The testicles were acutely affected in several cases, and the brain in some. M. Rilliet observed an epidemic in Geneva in 1848 and 1849.

M. Beraud (*Archives Générales de Médecine*, 5^e série, vol. xiii. pp. 274 and 557) describes, under the term "variolous orchitis," an inflammation of the testicle often occurring during variola. It affects occasionally the gland itself, but more frequently the tunica vaginalis and the epididymis, is attended with plastic deposit in the latter, and with the effusion of serum and fibrinous matter into the cavity of the tunica vaginalis.

"Epidemic catarrhal orchitis." In a recent epidemic of catarrhal fever, described by M. Desbarreaux-Bernard, of Toulouse, to which the prevalence of mumps imparted a special character, the inflammation of the testis appeared at once in several patients without any preliminary affection of the parotid whatever. *Med. Times and Gaz.* vol. xix. p. 512.

I do not remember to have seen a case of simple acute orchitis,—that is, an acute inflammation of the substance of the gland,—unless it were caused by a blow, or associated with mumps or some urethral irritation. Nor do I meet with a clear description of it in surgical writings. Still it is most probable that it does sometimes happen. In the Museum of St. George's Hospital is an example of "purulent deposits in the testicle in combination with synovitis:" but this was in a case of pyæmia. Mr. Ludlow has recorded a case, under the care of Mr. Stanley, in which acute inflammation of the body of the testicle, in a feeble person (a sufferer from stricture), went on to suppuration and gangrene of a portion of the glandular substance.*

In infants. Mr. Curling mentions some cases of inflammation attacking the testis of young infants. The symptoms were acute, and the swelling was considerable; but the disease soon subsided, and was always confined to one testis. I have seen a similar case, though rather less acute. The testis was very hard, and I judged that the inflammation was seated in the body of the gland. I could not discover any especial cause for the affection.

Epididymitis. The exciting causes of epididymitis are injuries to the organ from pressure, blows, &c., and some irritation in the urethra, more particularly in the part of the urethra contiguous to the orifices of the seminal ducts. Thus the affection sometimes follows lithotomy; the impaction in, or the passage of calculi through, the urethra; stricture of the urethra, or the introduction of instruments for the relief of stricture or for other causes; and, above all, the inflammation of the urethra attendant upon gonorrhœa. It may also occur spontaneously in persons of rheumatic or gouty diathesis, and in other persons.

In the acute stage of gonorrhœa pains are often felt in the testicle, accompanied by soreness; but these seldom are the immediate precursors of any thing further. They subside as the severity of the urethral affection abates; and the inflammation of the testicle does not commonly supervene till a later stage, when, perhaps, discharge is the only remaining symptom of the gonorrhœa. It may be induced, then, by slight causes, such as much exercise, especially on horseback, or by tight trousers. So long as the discharge lingers, so long is the patient liable to swelled testicle; and those

* See cases of partial gangrene of the testis, *Med. Times and Gazette*, vol. x. p. 338; vol. xiii. pp. 568 and 631.

Mr. Paget has "a specimen in which extensive deposits of lymph and pus are seen in the testicle of a man in whose urethra a portion of calculus was impacted after lithotripsy."

measures are most preventive of the latter affection which most quickly put an end to the former. The sudden suppression of urethral discharge may, now and then, by a sort of metastasis, induce inflammation of the testicle; but this is so rare an event that the apprehension of it need not influence our treatment of gonorrhœa. It has been supposed to be more common than it really is, because the onset of the inflammation in the testicle is generally, though by no means always, attended with a diminution of the discharge from the urethra; and cause and effect have been often confounded. That the affection of the testicle is rather the cause than the effect of the subsidence of the urethral inflammation is proved by the fact that it is very commonly excited by some injury; and, moreover, when it subsides, the urethral affection usually reappears. There is no evidence, in the greater number of cases, that the inflammation travels along the vas deferens from the urethra to the testicle. I do not know that we can offer any other explanation of its occurrence than is conveyed by the term "sympathetic."

The course and symptoms of the inflammation are much the same whether it accompany gonorrhœa or other irritation of the urethra, or be excited by some other cause. The epididymis is the part first and chiefly affected. Attention is attracted to the malady by pain which, after a time, is felt not only in the scrotum but in the groin, the iliac region, and in the loins. The testicle is tender; the end, usually the lower, of the epididymis is enlarged and very tender; and the vas deferens may also be thickened and tender. The whole of the epididymis soon becomes involved, serum and lymph being infiltrated in the cellular tissue between the convolutions of its tubes, so as to form an elongated mass at the back of the testicle; and the swelling is much increased by the effusion of fluid mixed with lymph into the cavity of the tunica vaginalis* and into the loose tissue of the scrotum. The skin also is inflamed. The pain is often very severe, dull, heavy, sickening. The bowels are generally constipated, and the patient is feverish and sick. The constipation and sickness have, in some cases, been so obstinate as to cause apprehensions of hernia. The inflammation rarely pro-

* The extension of inflammation from the epididymis to the tunica vaginalis, and *vice versâ*, takes place more readily than from the testicle, because the areolar tissue of the epididymis, which is the tissue usually attacked by inflammation, is in close contact with the tunica vaginalis, indeed is continuous with the attached strata of that tunic; whereas the areolar tissue of the testis is enclosed by the thick fibrous tunica albuginea, which separates it from the tunica vaginalis, and acts as a barrier against the passage of inflammation to and fro. The fluid in the cavity of the tunica vaginalis sometimes amounts to several ounces in these cases.

ceeds to disorganisation of the tissue, or even to suppuration. It generally subsides in a few days, leaving fluid and lymph in the tunica vaginalis and the epididymis enlarged and hardened. These remnants gradually disappear, and the organ resumes its natural size; and its function is commonly unimpaired. Such, at least, is the usual course, even when not modified by treatment. I have seen many cases which have been left without treatment, or even rest; but I do not remember any, where the inflammation was of a simple kind and in a healthy subject, which did not terminate in resolution, or any in which atrophy of the organ was clearly traceable to this cause.

Sometimes, when the inflammation has continued for a long time, and has extended from the areolar tissue to the tubular structure, the tubes become thickened and dilated, just as we find in the case of the ducts of the kidney and other organs when they have been the subject of chronic inflammation. These changes are dependent, partly, upon the direct effects of the inflammation, and, partly, upon distension from the secretion not finding a ready passage. They are not necessarily persistent; for, if the inflammation subsides, the tubes may gradually resume nearly, or entirely, their natural calibre. Occasionally the dilatation of the tubes is caused by seminal engorgement, consequent on obstruction or obliteration of some of them, as described by M. Gosselin.*

I have said that the epididymis is the part first and chiefly affected; but if the inflammation be very severe or long continued, it is liable to extend to the body of the testicle. At least such is the opinion of several pathologists;† and it is probable that it does so. It is certain, however, that it rarely proceeds to any great extent there, or causes much alteration in the tissue.

* *Archives Générales de Médecine*, 4^e série, xiv. p. 405, xv. 40. This author made several dissections where the tubes of the epididymis or the vas deferens were impermeable and transformed into fibrous or other structure; and it is worthy of remark that in none of them was there any atrophy of the substance of the testis. In some, the tubes below the obstruction were dilated; in some, they retained their natural size. The vesiculæ seminales were of natural size in all the instances in which they were examined. The cause which led to the obstruction, whether it were inflammation or not, was uncertain in each of the cases; but we learn from these observations that the absence of atrophy after an inflammatory attack is not certain evidence that the function of the organ is capable of being performed; which is in accordance with the observations and experiments at p. 540. Mr. Curling says that in only two cases where the epididymis had suffered from inflammation had he remarked a decidedly atrophied condition of the organ. He speaks of suppuration occasionally taking place.

† Velpeau, in *Diet. de Méd.*; Demme, in *Virchow's Archiv*, vol. xxii. p. 177; a writer in *Brit. and For. Med. Rev.* vol. xvii. p. 76. In the *Edinb. Med. Journ.* vol. vi. p. 455, is a case of acute suppuration and hernia testis supervening upon gonorrhœa.

Treatment. It is not usually necessary to adopt any severe plan of treatment. Now and then the disease may be arrested in its initiatory stage (that is, when the inflammation is commencing in one part of the epididymis) by well-adjusted pressure with plaster and bandage, or by antimony freely given, or by pressure and antimony combined: but the pressure often cannot be borne; and antimony, in large doses, though it sometimes causes a marked alleviation of the symptoms, not unfrequently tells more upon the patient than upon the malady. Leeches, especially if they be placed upon the scrotum, certainly increase the external swelling and inflammation; and their beneficial effect upon the testicle is often questionable. If they be placed above the scrotum, in the course of the cord, they do as much good and are productive of less annoyance. I have never tried the plan of opening the veins in the scrotum. Rest in the recumbent position; mercurial and saline aperients; antimony, given so as to produce and maintain nausea; with a spirit-lotion applied upon a soft folded rag, beneath a handkerchief so arranged as to support the part and prevent it hanging between the thighs and to keep it moist, seem to moderate the severity of the malady as much as sharper measures, and do little or no harm to the patient. It is very rarely advisable to give opium, and seldom necessary to affect the system with mercury. If the induration and enlargement of the epididymis linger more than usual, they may be reduced by pressure with plaster and bandage, or by iodine and mercurial ointment combined and rubbed upon the scrotum so as to produce slight irritation of the skin. It is important to secure the restoration of the part to a natural condition as soon as possible; forasmuch as the observations of M. Gosselin* indicate that a thickened indurated state of the upper or lower end of the epididymis often prevents the passage of the secretion of the testicle to the vas deferens; and that so long as it remains, though there may be all the signs of virility, with desire and power of copulation and emission, there is likely to be no impregnation, in consequence of the absence of spermatozoa in the fluid emitted.† If the fluid in the tunica vaginalis remains after the induration and swelling of the epididymis are gone, it may be treated as a case of ordinary hydrocele.

Sometimes the affection is prolonged, or recurrences of inflammation are induced, by the presence of a stricture or other source of irritation in the urethra; and when this is removed the testicle usually soon regains its natural state under appropriate management. In the treatment of obstinate or recurrent epididymitis it is, therefore, well to examine the condition of the urethra by passing a bougie. Such cases should not be neglected, because, as just pointed out, the tubes of the part are liable to be impaired or destroyed by the effusion of lymph and other effects of protracted inflammation.

Chronic inflammation, including syphilitic disease. Chronic inflammation of the testicle is seldom a relic of acute inflammation. It may be due to stricture of the urethra, or to injury; but the most common cause is syphilis; and the following account is drawn chiefly from the observation of that form of the disease. It usually occurs in what is called the tertiary stage of syphilis; the most frequent concomitant symptoms being inflammation of the bones and ulceration of the skin and throat; or it may occur alone, without any other secondary or tertiary symptoms; or it may commence after these have subsided. It is most frequent in those who are pale and feeble.

* *Archives Générales de Médecine*, 5^e série, vol. ii. p. 257.

† See obs. confirmatory of that view by Mr. Curling, *Brit. and For. Med.-Ch. Rev.* April 1864.

The inflammation is often insidious, and may at first be unattended with pain and confined to a part of the organ. The patient, perhaps, accidentally discovers that one or both of his testicles are enlarged and hard, or that some part of one or both is in this condition; and he may not be aware of the presence of any such disease till it has made considerable advance. The Surgeon should, therefore, examine the organs in suspicious cases; indeed, in all cases of tertiary syphilis it is well to do so.

Pathology. The structure chiefly affected is the areolar and septal tissue of the gland, as well as the tunica albuginea, and the mediastinum; and less frequently the areolar tissue of the epididymis. These tissues become indurated by the deposition of lymph into their substance, causing enlargement, hardness, and heaviness of the organ; and the deposit often takes place irregularly, affecting some of the lobules and not others, or affecting them unequally.

The knotty outline of the testicle, which, when present, is very characteristic of this disease, depends also partly, and in some instances entirely, upon another cause besides the unequal manner in which the lobes are affected, and that is, upon a deposit of lymph, or plastic material, in nodules or tubercles, in or upon the tunica albuginea, or in the areolar tissue of the testis. These nodules are sometimes very dense; they have commonly a whitish or faint yellowish-white colour, and are sparingly streaked with blood-vessels, which exist in greater numbers at their circumference; and they are described, by those who have examined them microscopically, to consist chiefly of fine nucleated fibres, and to show a tendency to oily degeneration towards the centre.*

If the disease subsides in an early stage, the lymph may be nearly or quite absorbed, leaving the tissue little impaired. If the lymph be more abundant, or be more organised, it is likely to remain, causing thickening and opacity of the septa and gradual contraction of them; and this contraction, as in cirrhosis of the liver, is attended with shrinking and wasting of the glandular substance. In this way, atrophy of the testicle, more or less complete, may be brought about. The disease in that stage is well illustrated by specimens (2351, ^{56, 57, 58}) in Guy's Hospital Museum, which are described as examples of "fibroid degeneration of the testicle" and are attributed to syphilis. In these specimens the glandular tissue is seen to have in great measure disappeared, being replaced by

* Virchow, in his *Archiv*, vol. xv. p. 263; and Demme, in *Virchow's Archiv*, vol. xxii. p. 181.

opaque white fibrous tissue, diffused and in nodules, which bears all the appearance of having been the product of inflammation. Both testicles are affected in a nearly equal degree in each of the three cases. The intermediate or glandular parts appear to be sound, also the vas deferens and the epididymis.

Sometimes, however, perhaps usually when the disease is long continued, the inflammation extends to the tubules, the walls of which become thickened and blended with the intervening tissue, according to Virchow,* while the epithelium lining them undergoes pigmental and fatty degeneration.†

Not long ago, examining a patient who died from other causes, I found both testes of about the natural size, hard and knotty, with the glandular structure almost obliterated, its place being occupied by a mass of firm indurated tissue like old organised lymph, except at one point where the natural structure appeared quite sound. There was no history in this case, but it was probably one of syphilitic disease. In some cases the gland-tissue is so entirely supplanted by fibroid tissue, and the symptoms that have attended the change have been so slight, as to suggest that it was a result, not of orchitis, but rather of a degeneration.‡

M. Vidal (de Cassis)§ lays great stress on the tendency to atrophy of the syphilitic testis. He gives, however, instances of the recovery of function in testicles which had been severely invaded by syphilitic inflammation.

A testicle which has been hard and knotty from chronic inflammation may remain in that state for years, undergoing very little change and being a source of little or no inconvenience. It may even, to some extent, perform its function. Under such circumstances the patient is not usually willing to submit to treatment; and if it be clear that the disease is not progressing, it is scarcely worth while to interfere; for the effused lymph, which is the cause of the hardness, has probably acquired such consistency that it will

* *Archiv*, vol. xv. p. 264.

† "The *coni vasculosi* become thickened, hardened, and of a dark-brown colour." "In general there are marks of inflammation upon the tunics of the testis, such as, for example, adhesion; the substance of the gland itself is changed, the septa are much more apparent than natural, the seminiferous tubes appear to be less in number, are undoubtedly much reduced in their size, and many become cords instead of tubes." "The absorption may proceed till the whole of the glandular structure of the organ is removed, leaving the tunica vaginalis adherent to the tunica albuginea and the septa within the latter; but the whole substance which remains is not larger than the extremity of the finger, and it feels a firm and very solid body." Sir A. Cooper, *On the Testicle*, pp. 23, 24.

‡ Dr. Wilks, at Path. Society, *Lancet*, 1859, vol. i. p. 538.

§ *Mém. de la Société de Chirurgie de Paris*, vol. ii. p. 92.

not become absorbed, except under the influence of means which may injure the health or do damage to the remaining tissue of the organ.

The disease is sometimes, though not very often, accompanied by effusion of fluid into the cavity of the tunica vaginalis. When it is so, we cannot judge of the condition of the testicle till the fluid has been evacuated.

By most authors this disease—"syphilitic sarcocele" as it is sometimes called—is not sufficiently distinguished from the scrofulous disease—scrofulous or "tuberculous sarcocele"—to be presently described. Yet there are very considerable and important differences between the two in their causes, their nature, and their treatment, as well as in the tissues primarily affected by them. The chronic inflammatory disease does not often originate spontaneously, but is due to a blow, to a source of irritation in the urethra, or to syphilis; whereas the scrofulous disease is not usually traceable to these causes, but is dependent upon the scrofulous diathesis. The morbid product, in the one instance, is situated primarily and commonly in the connective tissue, and has a tendency to fibrous development; in the other it exists primarily and chiefly in the tubules, though tubercles are sometimes developed in the connective tissue, and it has more the molecular or cell form, with tendency to oily, or caseous, or earthy, or more frequently purulent degeneration. The one disease may require antiphlogistic treatment, and yields more readily to mercury than to any other means; the other is rarely benefited by depletion or mercury, but requires measures directed to promote the general health. Both, however, are liable to suppuration and the subsequent protrusion of the glandular substance in the form of "hernia testis;" and this has probably led to the two diseases being confounded together.

Suppuration. The inflammation sometimes goes on to suppuration, the pus being formed in the substance of the testis and being, consequently, bound in by the tunica albuginea. Supposing it to be found only at one or two points and in small quantity, it may remain for a great length of time in the testicle; and becoming surrounded by a thick wall of lymph, it may dry up into a caseous or putty-like substance, or be the seat of calcareous infiltration, and so be ultimately converted into an earthy mass. Small abscesses in these stages of decline are not unfrequently met with in the testicle, and occasionally are symmetrical in the two testicles. They are commonly thought to be of tuberculous origin, and probably are so sometimes. It now and then happens that a small collection

of pus pent up in the testicle is a source of a good deal of irritation, and gives rise to frequently recurring attacks of inflammation. In the Museum of the College of Surgeons is a testicle with a small abscess in the epididymis; it was extirpated because it had for many years been the seat of the most severe pain.

When once matter is formed, however, it generally increases, as in the case of abscesses in other parts, and distends the tunica albuginea and other tissues of the testicle. It thus induces absorption, to a greater or less extent, of the glandular tissue, and gradually makes its way through the tunica albuginea, most commonly through the fore part. The tunica vaginalis becomes adherent; so do the superficial structures, and the matter is in course of time discharged through them. The aperture may continue for a time, and then close, the disease abating; or a succession of abscesses may form, burst, and heal.

Hernia testis. Sometimes, however, healing does not take place so favourably. The aperture in the skin is enlarged by ulceration, and discloses a firm coarsely granular mass connected with the testicle. The mass might be supposed, even when removed from the body, to be formed by granulations sprouting from the anterior surface of the testicle: a section, however, almost always shows that it is composed, as first pointed out by Mr. Lawrence,* of the indurated and altered structure of the testicle, pressed through the ulcerated opening in the tunica vaginalis, constricted where it is girt by the tunic, and expanding and granulating beyond it. It is seldom large, and the testicle has usually become much reduced in size when the protrusion takes place; so that altogether the protruding mass and the remnant of testicle often do not more than equal the natural size of the organ. The amount of the protrusion varies from a small nodule to the whole substance of the testicle. In some cases the entire glandular part of the testicle, and with it the mediastinum, is projected through the tunica albuginea, and stands out beyond the level of the skin; and even then, as just said, the protruding mass is not very large.

The integuments around the hernial protrusion are usually indurated, and more or less undermined. Sometimes they constrict its neck like a collar. Sometimes they are ulcerated as well as indurated, the ulcers spreading with everted edges and very painful, so that the disease presents many of the characters of cancer. In a case lately under my care the affection was thought to be malign-

* *Edinb. Med. and Surg. Journal*, vol. iv. p. 257.

nant, and had much that appearance; but under mercurial inunction the protruding mass shrank and the ulcers healed.

In this disease, whether the epididymis be implicated or not, the vas deferens is not usually diseased. In all the cases that I have examined, though some were of long standing and far advanced, that tube retained nearly or quite its natural size, and, so far as I could judge, its natural condition.

Diagnosis. The pain attendant on chronic inflammation of the testicle varies with the rate at which the disease progresses. When this is slow, there is often no pain at all, or merely an uneasiness which may not be constant. Indeed, as before said, the patient may be first apprised of the malady by finding one or both testicles larger than natural. When the testicle swells more quickly, the pain is often severe, dull, heavy, aching, extending to the loins. Sometimes it is perceived only in the loins. When matter is forming, there is usually pain; though this also depends upon whether it form quickly or not. The enlargement of the testicle from chronic inflammation may be distinguished from that dependent on other causes by its appearing first in the body of the testicle, and by the uneven, knotty feel, or stony hardness of the gland. The part is usually tender, and more or less painful. It rarely attains to any great size. The distinction between testicle and epididymis is soon lost; perhaps the latter becomes involved in the disease; and too frequently both testicles are affected, the disease probably showing itself at corresponding parts of the two organs. The presence or history of syphilitic disease in other parts of the body will further assist in the diagnosis. If there be hydrocele superadded, it may be impossible to recognise the condition of the testicle till the fluid has been evacuated.

Treatment. The greater tendency of chronic inflammation, as compared with the acute form of the disorder, to show itself in both testicles and to impair or destroy the glandular tissue of the organs, renders its treatment very important. It is also a more complicated and difficult matter than the treatment of acute inflammation of the testicle; for not only is chronic inflammation, under most circumstances, a more obstinate and less amenable affection than the acute, but in this case it is, in addition, often associated with, and dependent upon, a constitutional malady which requires very much patience and good management for its control. The local treatment is such as is suited to chronic inflammation of other parts:—rest, and support by means of a suspensory bandage, with perhaps the more decided pressure of an elastic bandage or of plaster. Well-adjusted pressure is an effective means of reducing the size of a testicle enlarged by inflammation. It is not of much service—indeed, it usually cannot be borne—when suppuration has commenced. Hydrocele, in addition to the enlargement, facilitates the employment of pressure; and I have remarked, that the fluid does not so easily disappear under its influence as does the more solid swelling of the testicle. The pressure may be alternated or combined with the application of iodine

and mercurial ointment; or the latter may be employed alone, for a great number of cases of chronic enlargement of the testicle will be found to yield to its influence. Leeches are sometimes of service. The best plan is to apply a few, three or four, upon the scrotum,—the objections to placing them on the scrotum, mentioned when speaking of acute inflammation, not holding good in the case of chronic inflammation; and they may be repeated two or three times a-week.

Attention to the general health forms a most important item in the treatment of most chronic inflammatory affections; but the directions must be regulated according to circumstances; and I simply allude to it here for the purpose of indicating that it must not be forgotten.

When suppuration has taken place the abscess should be opened early; and the opening should be maintained so as to insure a free vent for the matter. If a sinus remains long, after either the artificial or the natural opening of the abscess, it may be laid open and cauterised to the bottom. When the granular substance of the organ protrudes, forming what is called "hernia testis," a cure may often be effected by pressure with plaster carefully and perseveringly applied. The plaster should be renewed at least once daily, in some instances twice a-day. It is well to leave an hour or two between the removal and the re-application of the plaster, during which time the surface can be well cleansed and refreshed. Some lint or charpie, with nitric oxyde of mercury, or some stimulating fluid, may be placed upon the granulating mass beneath the plaster. If this plan fails, or is likely to fail, the protruding part may be removed with the knife or caustic; or, which is a better plan, the undermined skin may be divided, and all sinuses freely laid open, even if they extend into the substance of the testicle. The edges of the skin should then be pared away; and the skin having been separated from the testicle on either side, its edges are to be united in front of the testicle by suture, as suggested by Professor Syme. It may be desirable to remove the protruding part before approximating the edges of the skin, as practised by Sir A. Cooper: this, however, is not often necessary; for the granular mass, when it is covered by the skin, sometimes shrinks, and gives no further trouble. If the union of the skin fails, and suppuration takes place beneath it, and the granular mass reappears, a cure is still not necessarily to be despaired of; and it may be promoted by attention to the general health, and by stimulating applications or pressure. I have also heard of an operation performed in Glasgow, and devised by Dr. Pagan of that city, which consists in dissecting down methodically to the tunica albuginea, and then incising the margin of the aperture in that tunic like the ring in a strangulated hernia. After this the treatment of the affection is said to be much more successful. We should be unwilling to remove the organ, because, even in the very worst cases, a sufficient amount of glandular structure sometimes remains so far unimpaired as to perform its function or to admit of being restored for that purpose. It may, however, be desirable to resort to this measure if one testicle only is involved, when the disease in it has been extensive, and when the state of the patient's health requires a speedy relief from the local source of irritation.

When the chronic inflammation of the testicle is part of a syphilitic affection, which is very often the case, the treatment must be conducted in accordance with the principles laid down in the essay on SYPHILIS. I will only here remark that the plan which I have found most effectual, indeed rarely to fail, in chronic orchitis, whether there be a syphilitic history or not, if commenced before suppuration has taken place, is the rubbing in of mercurial ointment. A small quantity is to be rubbed into the scrotum, or any other part of the body, once or twice a day. It is scarcely necessary to carry the mercurial influence upon the system to such an extent as to affect the gums. Small doses of the iodide of potassium may be given at the same time; and the decoction of sarsaparilla, made fresh, and taken to the amount of a pint or a pint and a half daily, is very beneficial when the patient is debilitated. In

this and other syphilitic affections the mercurial infraction has, so far as my observation goes, proved more effectual than the fumigation or bath; and, with a little care in varying the place of its application, the irritation of the skin liable to follow its use may be avoided. Even when suppuration has taken place, the mercurial influence may be beneficial in promoting the removal of the effused lymph, and, occasionally, in determining the absorption of the pus.

In syphilitic cases I have known the ulcers of the skin, consequent on the bursting of abscess formed in the testicle, and accompanying the hernial protrusion, to spread quickly with foul surface and sinuous edge, and to be attended with great pain. Under the use of opium, combined with other measures for supporting the skin, so as to relieve it of the pressure of the testicle, and for reducing the size of the testicle, this serious aggravation of the malady may be overcome.

Those measures which most tend to arrest the disease, and promote the removal of the effused lymph, are the most calculated to prevent the atrophy which is liable to ensue upon chronic inflammation of the glandular structure of the testis. The atrophy may commence during the swollen state of the organ; indeed, atrophy and enlargement may go on together. We do not, however, obtain evidence of the former till the swelling subsides. We then find that the diminution does not stop when the organ is reduced to its normal size, but continues, and may go on till the testicle almost entirely disappears. I do not know that any means can be adopted which give much hope of staying the progress of atrophy. An invigorating plan should be pursued,—fresh air, cold ablutions, nutritious diet, &c.

A recurrence of the disease—and this has been found to take place in several instances—is best prevented by continuing the mercurial influence, in a slight degree, for some time after the testicle has resumed its natural state. This treatment should be combined with a general tonic regimen and measures calculated to promote the general health. The compound decoction of sarsaparilla certainly has a beneficial effect in these cases.

I have thought it best to consider syphilitic orchitis in conjunction with common chronic orchitis, because the two affections correspond closely in nearly every particular. The symptoms and course of the two are the same. Their pathology, so far as we can judge from external examination, is the same. There is the hard knotty enlargement, commencing usually in the body of the testicle, but affecting often the epididymis; there is the tendency to suppuration, to hernia testis, and to atrophy. And this view of the pathological relationship is confirmed by the few opportunities which have been afforded of examining syphilitic testes in the early stage of the disease. The treatment is the same; the only difference being that where a syphilitic virus is present, the tendency to recurrence of the disease is greater, and the remedies must, consequently, be more perseveringly continued. Lastly, and this is not the least important reason, the two affections can be distinguished only by the history, or by the presence or absence of other symptoms; and it is probable, if not certain, that many—I would say most—of the cases supposed to be examples of simple orchitis are, in reality, the result of syphilitic disease.

Scrofulous or tuberculous disease is one of the most common affections of the testicle,—more common than is generally supposed. It is most frequent in young men; but is sometimes met with in children and in aged persons. It is often associated with phthisis, and may be found in the examination of many of the victims of that disorder, in whom there has been no suspicion of its existence during life. Ordinary inflammation—acute and chronic—has just been described as displaying itself, chiefly and

primarily, in the intertubular areolar tissue and in the fibrous septa of the testicle and epididymis. Scrofula, on the contrary, is very much a disease of the tubular structure, the areolar and fibrous tissues being involved, in most cases, only secondarily, in consequence of the inflammation which ensues, or by the development of tubercles in them; and often they escape till a late period. It attacks both the testicle and the epididymis, though not appearing in quite the same form in both, or at quite the same time.

Affecting the epididymis. As a general rule, to which there are many exceptions, it appears earlier, and progresses more quickly, in the epididymis. The convoluted tubes of the epididymis become swollen and distended with white scrofulous matter, which is at first contained within the tubes, blended with the epithelium, and is made up probably, in part at least, of accumulated and morbid scales of epithelium. In this condition the epididymis is enlarged in part, or usually in its whole length, to the thickness, perhaps, of one's finger; and, thus swollen, may be felt embracing the hinder, upper, and lower parts of the testicle. It is smooth on the surface; and the unaltered areolar tissue may be dissected from it, so as to disclose the tubular structure, which is still quite apparent, and which may be, to a greater or less extent, unravelled. The disease extends, commonly, for some distance up the vas deferens; and that tube becomes enlarged to two or three times its natural size and is filled with yellowish-white scrofulous matter. Soon the mucous and other tissues of the tubes of the epididymis become infiltrated with, or degenerated into, the scrofulous substance, and gradually disappear, so that the coils of the tubes are blended and lost; and the epididymis is thus, more and more, converted into a mere bag of scrofulous matter. At the same time that matter softens; and, when the softening takes place, the surrounding areolar tissue inflames, and is infiltrated with serum and lymph, preventing the free movement of the skin upon the part. As the softening progresses to suppuration, the epididymis becomes distended and fluctuating, presenting the condition of a scrofulous abscess; the skin becomes more adherent and inflamed, the intervening tissues are removed by absorption, and, the abscess bursting or being opened, the ordinary turbid scrofulous pus is discharged. The opening does not soon close, but continues for a long time—for months or years—to give vent to a thin watery fluid, and now and then to portions of earthy matter; and a narrow channel, with thick walls, feeling like a cord, may be traced from the skin to the diseased part of the epididymis. Commonly other abscesses form

in a similar manner, and either burst through the same opening or give rise to other sinuses.

Affecting the body of the testis. While these changes are going on in the epididymis, the disease makes its way into the rete and body of the testicle; unless, indeed, it has previously commenced in those parts. The rete becomes enlarged and consolidated; and its structure appears to undergo the same changes as that of the epididymis. In the body of the testicle the disease shows itself, at first, in a less uniform manner than in the epididymis. It appears in the form of small gray tubercles—very like the gray tubercles of the lungs—sparingly scattered through the tubular structure.* They do not, however, appear to resemble the pulmonary tubercles in softening down into separate vomicæ; but they enlarge and become confluent, and so occupy and consolidate considerable portions—it may be the whole—of the glandular structure, the intervening tissue remaining unaffected. Thus we occasionally find the lobes of the testicle more or less swollen from infiltration of yellowish-white scrofulous matter, yet distinct from each other, and separated by the areolar tissue and the fibrous septa which still retain their natural characters. In other cases the areolar tissue becomes thickened, coarse, and indurated, as in ordinary chronic inflammation; or it may be absorbed, the lobes, as well as the tubes, being thus rendered confluent into one opaque, yellowish-white, cheesy substance, which fills up the whole space enclosed by the tunica albuginea. Soon softening commences, usually at the middle of a lobe; and an abscess is formed, which makes its way through the tunica albuginea and the superficial structures, just in the same manner as does the ordinary chronic abscess. As in that case a protrusion of the altered substance of the testicle—"a hernia

* "The small isolated yellowish-gray bodies found in the testicle in the early stage of the disease are composed of coils of diseased seminal tubes with altered contents." "The contents consist mainly of large cells, some of which exhibit vesicular nuclei and are disintegrating; of smaller shrivelled cells, or irregularly-shaped nuclear particles, and of a small quantity of granulo-molecular matter. The distension of the tubules in some places is sudden and globular, so that the distended portion, with its contents, forms a small tumour." "The matter accumulates until the tubes burst, and their contents are extravasated among the surrounding tissues." "With further disintegration more molecular matter and fat are developed, and, at last, earthy salts." Dr. Andrew Clark, in *Curling on the Testicle*, p. 282, and *Trans. of Path. Soc.* vol. vi. p. 91. In vol. ix. Dr. Clark adds, that the "deposit has a different structure at different periods of its growth, and at different parts of the same deposit. Thus, in the centre of a large deposit the structure is chiefly granular, at the circumference chiefly cellular." In one specimen he found numerous fine crystals of the triple phosphate between those tubes in which the deposit was being produced. The relation of these crystals to the pathological process he has not determined. See drawing by Cruveilhier, *Anatomie Pathologique*, livraison 9^e, pl. 1, fig. 2.

testis"—may follow, forming a coarsely granulated mass, covered, perhaps, wholly or in part, by soft white detritus of tissue, and presenting through the ulcerated opening in the skin. The changes that have been described may go on, *pari passu*, in the testis and in the epididymis; so that the glandular substance may be disorganised, and may present at the fore part of the scrotum, while the epididymis is converted into abscesses bursting through the hinder part and sides. I have also seen the swollen but unbroken body of the testicle, simulating "hernia testis," protruded through the skin, which was ulcerated and undermined in consequence of the formation, spreading, and bursting of abscesses from the epididymis. More commonly, however, the disease in the one part of the organ progresses more rapidly than in the other; and we find, accordingly, that when the epididymis has suppurated, there are often only a few tubercles in the testis, and when the latter is infiltrated or softened, the epididymis may be merely altered in shape, spread out upon, and, so far as external appearance goes, blended with the testis.

Tubercles. Associated with this scrofulous affection of the lining membrane and epithelium of these tubules there may be found genuine tubercles—the "miliary tubercles" of Laennec, the "granular or knotty tubercles" of Virchow—occupying the delicate connective tissue between the tubules. They sometimes exist alone, or precede the disease of the tubules. They enlarge by formation or proliferation of cells on their exterior, and become aggregated into larger masses, between which the tubules are compressed and destroyed; so that, in time, the affected lobules are converted entirely into tuberculous matter. Or, more commonly, the tubules are diseased at the same time, so that their walls are destroyed, and the scrofulous matter in their interior is rendered confluent with the tuberculous matter on their exterior, forming a homogeneous mass, which undergoes the changes just described. These tubercles are found, most frequently, in the hinder part of the lobes of the testis, near to the mediastinum, and are regarded as indications of a more depraved constitutional diathesis than the scrofulous affection of the tubules. It is, however, impossible to distinguish during life between the two; and, even when the part has been removed from the body, it is not easy to decide whether the small spherical white bodies, commonly recognised as tubercles, are the genuine tubercles of the areolar tissue, or are the result of a degeneration of the tubular structure. Neither is the distinction of much practical or pathological importance. Probably it is the

same disease in both instances, the difference consisting simply in the tissue in which it is seated.*

Scrofulous disease often affects both testes, though it is commonly more advanced in one than in the other. It is liable to extend along the whole length of the vas deferens, and to involve the vesiculæ seminales and the prostate gland, leading to changes in them corresponding with those in the testicle. I have also seen cases in which the disease was not confined to the genital tubes, but affected those of the urinary system also, causing dilatation of the ureters, pelvis, and calices of the kidneys, with thickening and degeneration of the lining membrane and epithelium, so that the swollen tubes were almost choked up with the scrofulous matter, while the cortical substance of the kidneys was streaked and spotted with yellowish-white deposit, or riddled with abscesses.

Reparative processes. To what extent reparation may take place it is difficult to say. The examination of morbid specimens helps us very little. Clinical observation gives great reason to believe that, under favourable circumstances, scrofulous and tuberculous matter may undergo complete absorption, leaving the tissue which had been occupied by it quite unimpaired; and the inference derived from pathological investigation of similar products in other parts of the body is that they may fall into a quiescent state, the more watery elements becoming absorbed, while the remaining constituents are impregnated with oily matter or saline particles, so that the mass is converted into a substance like putty or soft cheese, or, finally, into a dry earthy lump composed chiefly of carbonate of lime. While these changes are going on, the mass is enclosed and isolated from adjacent parts by a capsule of lymph effused around it. We often see small circumscribed earthy masses in the body of the testicle, perhaps in the corresponding parts of the two testicles, or in the epididymis; and analogy leads to the supposition that some of these are the remnants of tuberculous disease, which has subsided and done little injury to the organ; and we occasionally find circumscribed tuberculous lumps which would be likely to be converted into these earthy masses. The knowledge of such conditions assists us in our practice; for it is not difficult to recognise these masses in the living subject, and we can relieve the patient's fears by the assurance that they are of little importance.

* See "Ein Beitrag zur Kenntniss der anatomischen und klinischen Bedeutung der sogenannten Hodentuberkel," von Dr. Hermann Demme, in *Virchow's Archiv*, vol. xxii, p. 155.

Granted that they are of the nature supposed, they must be the result of very limited manifestations of the disease. It might be said that they do not warrant much hopefulness of the favourable termination of a more general invasion of the organ by scrofula. Nevertheless, my own experience of the disease, clinically, makes me very unwilling to condemn a testicle, even though it be the seat of severe and extensive scrofula. It is impossible to know that all the tubules are involved; and I have often been astonished at the good results that have followed, in apparently hopeless cases, from judicious treatment when the circumstances were favourable to the improvement of the health and the subsidence of scrofula. Particularly should this be borne in mind when, as so often happens, both testicles are diseased.

Diagnosis. The recognition of the disease is not difficult. The appearance of the patient, the enlargement of the epididymis with thickening of the vas deferens, and, perhaps, enlargement of the testis, followed by slowly forming abscesses without much pain, the pain being chiefly confined to the period when the skin is inflamed, leave usually little doubt as to the nature of the case. Nevertheless, there are cases which deceive even the most experienced; and now and then a scrofulous testicle is removed under the supposition that it is malignant.* The condition of the lungs should be investigated, especially when the patient has the tuberculous aspect. It is also well to inquire into the condition of the urinary organs; and, if there are any symptoms of disorder in them, to examine the state of the prostate and the vesiculæ seminales, remembering that those parts not unfrequently suffer in the same manner as the testicle. Sometimes the disease is more advanced in them than in the testicle, but not commonly.† Hydrocele is not an ordinary accompaniment; but when it is present, the true nature and extent of the disease will probably not be ascertained till the fluid has been evacuated. It is not usually a painful disease. It may be grafted upon an attack of acute inflammation in those who are of scrofulous temperament; and this should be borne in mind in the treatment of epididymitis in such persons, and should induce us to adopt an invigorating regimen as soon as the subsidence of the acute symptoms will permit it. It may be induced by a blow. Often the disease has made considerable advance before

* *Med. Times and Gaz.* vol. xv. p. 452.

† Report of discussion at la Société Anatomique, *Medico-Ch. Review*, vol. xxviii. p. 272.

it attracts the patient's attention; and he discovers by accident a lump at the hinder part of the testicle, or in its substance. Sometimes the part is painful and tender at the onset, and it is commonly so when softening and suppuration are going on.

Treatment. The treatment consists, principally, in means calculated to improve the general health and impart vigour to the nutritive processes; and of these, fresh air out-of-doors, and well-ventilated, well-lighted apartments stand first in importance. Unless the pain and inflammation be such as to necessitate repose, the patient should be encouraged to go out, and to select—if it be in his power—a cool, bracing, rather elevated residence. He has less to fear from exposure to wet and vicissitudes of weather than from confinement and inaction. The poor man had better, if he can, remain at his daily out-of-door work than rest in the ward of a hospital. In the case of the town-artizan the importance of this treatment is paramount. It is often the only thing wanted; but, unfortunately, it is often the thing which cannot be obtained, and we have to struggle on feebly with other means. Next in importance is a rather liberal supply of nutritious food—meat and beer—sufficient to satisfy the appetite, not to quench it. At the present day the last caution is much needed; for numbers of invalids are so plied with food that a natural appetite, and the vigorous digestion attendant upon it, are not suffered to exist. Sponging of the part, and of the body generally, with cold water is a useful adjunct. Steel, quinine, acids, cod-liver oil, are often of service. Iodine is thought much of by some persons; but its good effect in this and other scrofulous affections has not been so apparent to myself as it seems to have been to some practical men who have paid much attention to this class of diseases, and whose opinion deserves great weight.

The local treatment, though secondary to the general, is not unimportant; and where there is not the opportunity to carry out the measures on which we most rely, we must be the more persevering with those which are less effective. The part should be suspended, if it be painful, and soothing applications made. If it be not painful, it should be well sponged or sluiced with cold water several times a day. This is the best appliance, fortunately it is an easy one; but there is often an inattention to it on the part both of the Surgeon and the patient. An external stimulant sometimes does good; and iodine, in a fluid form, is more manageable and answers the purpose better than any other application. It should be used so as to produce a slight scaling of the skin. Abscesses may be allowed to burst, especially when they proceed from the epididymis. I do not think much good is done by opening them. In some very bad cases, where the organ seemed nearly destroyed, I have seen very good result from freely laying open the sinuses and cavities, turning out the scrofulous matter and softened structure, cleaning the part by washing and wiping, then freely applying nitrate of silver, and plugging the wound with lint, so as to induce active suppuration. At any rate, it is worth while to try this before determining to remove the organ. The healing of the sinuses which result from the bursting of abscesses cannot be much expedited in any other way. If the disease be not extensive or progressing, they may be left, and in the course of time they will close.

Excision. We should be unwilling to proceed to extirpation of the organ, unless its presence is a great source of irritation and a drain upon the patient's health, preventing his getting about, and so tending to induce disease in the other testicle, or to aggravate the disease which may already exist there. It is surprising how this organ and other parts do, under favourable conditions, contrive to recover from scrofulous disease, and to resume their functions, though their structure was, to all appearance, completely disorganised. Moreover, it seldom happens that the whole of the glandular tissue is involved; and a small part of this may be sufficient to carry on the requisite

function.* When the epididymis and vas deferens have been blocked up by scrofulous matter, or damaged by abscesses, the prospect of recovery to useful purpose is more hopeless. Still it is difficult to decide, for certain, by external examination, to what extent structural disorganisation has taken place; and it is almost impossible to be sure that the tubes are so far destroyed as not to admit of being cleared out by absorption or discharge of their contents, and of being again enabled to afford a passage for the semen.

In considering the question of removal of the organ, the condition of the patient's health is a very important item. If he become more and more reduced, in consequence of the irritation and suppuration in the part, and of the confinement imposed by it; and if the local and general measures that are available, and usually serviceable, fail to produce a good effect, there is no alternative but the removal of the diseased part; and we should not be deterred from resorting to this step because of the presence of scrofulous disease in other parts of the body, or by the apprehension that, if it be removed in one place, it may make its appearance at another. I know that this idea is very generally entertained; and I think it is allowed to influence Surgeons in their practice more than it ought to do. I do not deny that there may be some foundation for the idea; though I have never felt sure that it is laid very deeply in that which is the only reliable ground, namely, careful and extended clinical observation; and I think the converse statement is at least equally, if not more generally, true, viz. that the *existence* of scrofulous disease in one organ *predisposes* very greatly to its manifestation in others. We can understand that it should do so, not simply in accordance with the rule that disease tends to beget disease, and that disease of its own kind, but because it lowers the general health, and so renders the whole body a more easy prey to that or any other malady; and we find that it does this when we observe the numerous cases in which patients, worn down by scrofulous abscesses of the vertebrae, the joints, or the testicle, fall victims to tubercles in the lungs or the abdomen. It is remarkable that, in the face of these cases of every-day occurrence, the Surgeon should still be deterred from relieving the system of a scrofulous organ by the apprehension I have mentioned. Upon the same principle, he should fear to restore a scrofulous organ by any of the ordinary means of treatment. If such a part be clearly a source of irritation and depression to the constitution, there can be little question that its removal will tend to prevent the accession of scrofula elsewhere. I think we may go a step further, and assert that the removal will not only tend to prevent the accession of scrofula but also to promote the restoration of organs which may be already affected by it. I have in several instances seen the health of phthisical patients much improved, and the condition of the lungs ameliorated, after amputation of scrofulous joints, or the excision of scrofulous testicles.

CYSTIC DISEASE,

constituting the "hydatid testis" of Sir A. Cooper, is not of very frequent occurrence. It resembles that in the mammary gland, the ovary, and the kidney, inasmuch as it consists of an agglomeration of thin-walled cysts varying in size from that of a pin-head to that of a walnut, and of globular shape, modified by their mutual pressure. They contain fluid, which is mostly thin and

* "When the testis is, to a great extent, disorganised by the effusion of tubercular matter or lymph, and forms an open fungoid sore, secretion may still go on under excitement, as is evinced by the stiffened state of the dressings and a microscopic examination of the discharge." Curling, *On the Testis*.

colourless, but which is sometimes viscid and tinged with blood or other colouring matter. They appear to originate in the substance of the gland, but whether in the tubular structure or in the areolar tissue connecting the tubules is not certain.* They form masses attaining considerable size, and weighing, it may be, some pounds. As in the corresponding disease of the mamma and the ovary, the cysts are sometimes more or less occupied or distended by firm, fibrous, lobulated and pedunculated bodies growing into them. These bodies, examined by Mr. Quekett, were found to possess a cellular structure and to be covered on the surface with cylindrical epithelium, like that covering the villi of the intestine;† or they may contain small, hard, spherical bodies like pearls, composed of concentric layers of condensed epithelium.‡ A variable amount of fibrous tissue is formed with, and intervenes between, the cysts. In some instances it is of small quantity and delicate; and the mass is then composed almost entirely of cysts. In other instances it is much thicker. It may be so thick as to constitute the chief element of the tumour; and the cysts then look as if they were mere secondary formations. To such the term "fibro-cystic tumour" has been given.

In most of the cases of cystic growth which have been carefully dissected, it has been proved that the disease was not diffused through the organ, but originated and was circumscribed in one part, and that as the tumour grew, the unaffected portion of the testicle was pressed aside or spread out over the mass; so that in some the mass, which is usually spherical, could be dissected or shelled out, leaving a considerable part of the testicle uninjured. In other cases, however, although the glandular substance of the testicle could be discerned spread out upon the tumour, and microscopical examination

* Mr. Curling, op. cit. p. 322, from the microscopical examination of two cystic tumours, confirms Sir A. Cooper's idea that the origin of the cysts is in a dilatation of tubes. "In some specimens a tube could be traced to a termination in a dilated pouch. In others a cyst appeared to arise from a lateral dilatation of a columnar tube, or at the extremity of a loop; whilst in the others the dilatation appeared to be uniform." These dilated tubes and cysts were lined by a tessellated epithelium, but contained no spermatozoa. He concludes that the tubes are not derived from the tubuli seminiferi of the glandular part, or from the ducts of the epididymis, but from the *rete testis*. If the cysts be really formed by dilatation of the seminal tubes, it is remarkable that spermatozoa are never found in them. Billroth (*Virchow's Archiv*, vol. viii. pp. 268, 433) traces the cysts to outgrowths from the seminal canals, herein according with the views of Reinhardt, Meckel, Förster, and others. with regard to the formation of cysts in the mammary gland. In one case he found it to have been produced by a growth and metamorphosis of the connective tissue.

Mr. Paget thinks "it is essentially a fibrous or fibrous and cartilaginous tumour in the testicle, with more or less of cyst-formation in the tumour." *Lectures on Surg. Path.* by Turner, p. 478.

† Curling, p. 320.

‡ Virchow, *Archiv*, vol. viii. p. 399.

proved its natural structure to be preserved, yet it could not be cleanly dissected away from the tumour. In some cases, also, a certain amount of gland-tissue has been found dispersed through the cystic mass. The epididymis, at first unaffected, becomes flattened, compressed, and wasted.*

Diagnosis. The disease is most frequent between twenty and fifty.† Its presence may be suspected when one testicle gradually and steadily enlarges, acquiring an oval or nearly spherical form, and is of moderate weight, heavier than a hydrocele, less heavy than a solid tumour. It feels elastic, but less decidedly fluctuating than a hydrocele. The affection is probably painless, and is unattended with any constitutional symptoms or indications of a predisposition to disease. The absence of transparency forms the chief distinction from hydrocele; and the slow rate of its growth may aid us in discriminating it from encephaloma. The diagnosis, however, from the latter disease, from hæmatocele, and from non-transparent hydrocele, cannot, in some instances, be arrived at with certainty except by the aid of punctures with a good-sized trocar. The instrument may be introduced at several points, and will probably give vent to a small quantity of clear fluid from each, indicating that several cysts have been punctured in succession. A grooved needle or a small trocar do not afford sufficient information, as they are liable to be blocked up by the clots or small flakes of lymph which may be present in hæmatocele or hydrocele.

Treatment. Castration is the only remedy; and it may be resorted to as soon as there is evidence of the presence of the disease. It might be thought, forasmuch as the glandular tissue is usually found, in part, healthy and spread out over the tumour, that the latter might be enucleated, and the gland or sufficient of it left to perform function. It is possible that this might be so in some cases, though it is scarcely compatible with the view that the disease has its origin in the *rete testis*. Supposing there to be only one testicle, and that one the seat of cystic disease, it would be well to cut cautiously down to the tumour, and endeavour to dissect or tear it away from the containing capsule, in the hope of leaving some of the tubuli and the efferent ducts uninjured. In ordinary cases, however, where the other testicle remains sound, the pro-

* In a specimen examined by Mr. Ludlow (*Trans. Path. Soc.* vol. v. p. 216), the vas deferens, immediately continuous with the epididymis, was impervious and had been converted into a fibrous cord; the cysts were lined by a single stratum of spheroidal epithelial cells, and contained intra-cystic growths of firm fibrous tissue, cells in various forms and stages of degeneration, and some crystals of cholesterine.

† A rare instance of its occurrence in very early life, if not congenitally, is given in the *Trans. of Path. Soc.* vol. vii. p. 241. In this instance the cysts were lined with ciliated epithelium, and, in the opinion of the writer of the report (Dr. Carter), could not possibly be connected with the seminal tubes. There were also osseous spicules in the fibrous tissue, having lacunæ of irregular form and disposition, but no cartilage-cells.

spect of success from this procedure is scarcely worth the risk of the additional inflammation and suppuration which it entails.

The disease is in itself of a benign nature; is usually confined to one testicle; and when it is so, the patient may live for years after its removal, marry, and have children.

Association of malignant disease. It has been observed, however, that in several instances the result has been less fortunate; the patient, after the lapse of a few months, being carried off by encephaloid disease of the lungs, absorbent glands, or other parts. This has naturally thrown a suspicion over the cystic affection, and has led many Surgeons to regard it as of malignant nature. The truth appears to be that, though really of simple character itself, the cystic tumour is very liable to be associated with malignant disease, and therefore it practically deserves the suspicion with which it has come to be regarded. In these cases, if a microscopical examination of the tumour be made, the character of the disease may be commonly discovered by the presence of cancer-cells in the cavities of the component cysts or in some of them. It is not certain, under such circumstances, whether the disease is originally of cancerous nature, or whether the cysts are, at first, simple, and the cancer-cells are subsequently engrafted on them. Perhaps the former is the more probable, because we find, as a general rule, that growths which are cancerous are so from the beginning, the change from a benign to a malignant character being the exception. There are, however, some features which suggest the other view in these cases. Thus the relative amount of the cancerous to the other elements seems to increase as the disease goes on; and we sometimes find parts of the growth consisting entirely of simple cysts, while in other parts cancer-cells abound, and at certain points the mass presents the ordinary characters of encephaloma.

We learn from this that the prognosis as to the result after an operation in cases of cystic disease cannot be given without reserve, since it is impossible to tell whether the cysts are of a simple character or not. The cases which have progressed most rapidly are to be regarded with greatest suspicion, forasmuch as cystic tumours combined with encephaloma grow more rapidly than when they are of simple nature. Even after the tumour has been removed, a mere examination with the eye is not a sufficient test. The fluid should be taken from various parts of it, and submitted to inspection under the microscope, before we can venture upon an opinion as to the prospect of an invasion of other organs by the disease.

Mr. Curling has noticed the occurrence, in some of the cysts, of

a solid whitish matter, exhibiting the characters of cholesteatoma, both in cases where the disease was malignant and where it was not malignant.

Association with enchondroma. Another very frequent attendant upon cystic tumours is the formation of cartilage growths; so frequent, indeed, as to have elicited from some pathologists the statement that cystic and enchondromatous growths nearly always exist together. The cartilage usually is in the form of nodules, which appear to occupy and grow from the interior of the cysts. The nodules are sometimes found to be strung together into lines; and this corresponds with the view entertained by Curling, Hogg,* and others, that the cysts are the dilated tubes of the testis or its rete, and that the cartilage is produced in them. In a case examined by Mr. Paget,† the cartilage was disposed in tortuous, cylindrical and knotty pieces, which appeared as if embedded in filamentous tissue, but were, apparently with good reason, judged to be in the lymphatics of the gland. Further examination of these cases, however, is necessary to decide positively which of the structures is the seat of the cartilaginous growths; whether they originate in the cysts, or in the intervening tissue and sprout into the cysts; if they originate in the cysts, it is still uncertain whether the cysts are diseased and dilated seminal tubes, or diseased and dilated lymphatics, or whether they are formed in the connective tissue of the gland.

The cartilage has the external characters and appearance of true hyaline foetal cartilage, and very nearly corresponds with it chemically and microscopically. The cells are rather smaller, and clustered rather more closely and irregularly, than is usual in foetal cartilage; and there are usually somewhat greater differences in the consistence and colour of the several parts of the same mass. In some places it may be quite firm, and in others very soft; and, though it is for the most part pellucid and colourless, or with a faint bluish-white hue, in some spots, usually at the centre of the nodules, it is more opaque and yellowish. This may be due to a simple change of colour; or it may indicate that a process is going on allied to ossification, but resembling it less closely than the ossification which takes place in the enchondromatous tumours found in connection with bone. The structure becomes infiltrated in patches with earthy matter, which, if we may rely upon one an-

* *Trans. of Path. Society*, vol. iv. p. 180.

† *Medico-Chirurg. Trans.* vol. xxxviii. p. 248.

alysis,* is composed of a large proportion of phosphate of lime; still there are no true bone-cells or canaliculi. The "calcifying" or "ossifying" process is observed to have taken place to the greatest extent in those tumours which are of longest standing and of slowest growth; and if the growth were to be arrested, it seems probable that the whole tumour might become impregnated with earthy matter, so as to form little more than a hard concrete mass. I have not, however, met with any specimens in which this has taken place.

I have said that the growth of cartilage is usually consequent on the cystic growth, engrafted upon and subordinate to it, the nodules of cartilage appearing to be developed in the cysts, and forming but a small part of the mass. In some cases, however, the formation of cartilage proceeds so rapidly, exceeding that of the cysts, that the latter become choked up, and the traces of them are nearly lost; perhaps in many parts they are quite lost.† Or the cartilage may be developed in the tissue without there being any intermediate cystic formation. It appears to have been so in Mr. Paget's case. In this very remarkable and exceptional, if not unique, case the disease extended up the lymphatics into the abdomen; a cartilaginous growth projected from one of them into the vena cava, and there were numerous masses of the same nature in the lungs.

The presence of enchondroma may be suspected by the weight and hardness of the mass. The complication makes no difference either in the treatment or the prognosis of cystic disease. Encephaloma may be associated with it, usually occupying a part of the cystic mass which is free from cartilage, though we sometimes find the nodules of the latter enveloped in the soft tissue of the cancer.‡

* Mr. Barry found 100 parts of a tumour described by Sir A. Cooper as "very hard, in some parts cartilaginous, in others ossific," to be made up of phosphate of lime 45 parts; carbonate of lime, with a trace of magnesia, 17 parts; animal matter 38 parts. *Trans. of Path. Society*, vol. iv. p. 184.

† In the case described by Mr. Curling, p. 324, "the enchondroma was developed so abundantly as to encroach upon and obliterate the cysts and to form the chief bulk of the tumour."

‡ Dr. Lotzbeck (*Virchow's Archiv*, vol. xiv. p. 394) concludes, from the examination of two specimens in which cancer was combined with enchondroma, that the cancer is the after-product and results from a metamorphosis of the cartilage-cells.

The results of 16 cases of cystic sarcoma of the testis tabulated in *Med. Times and Gaz.* vol. xi. p. 395, is as follows: The average age, 40; extreme ages, 18 and 58. Average duration, 21 months; extremes, 3 months and 11 years. Supposed cause, blows in 5. All recovered from the operation. There were cysts in all, enchondroma in 3, cancer in 1, cholesteatoma in 1. The gland-structure was expanded over the tumour in 8, lost in the tumour in 4, not described in 4. The epididymis was healthy in 6, involved in the disease in 3, not described in 6. Intracystic growths were developed in 3.

Fibrous tumour. A drawing of what appears to be a well-marked fibrous tumour of the testicle is given by Cruveilhier,* who observes that it closely resembled a fibrous tumour of the uterus, or rather the tissue of an unimpregnated uterus. It resisted and creaked under the scalpel. It was composed of contorted and interlaced grayish-white fibres forming lobules, with vessels penetrating their interspaces. It was very heavy in comparison with the size, which was twice the natural size of the testicle. At the upper part of the tumour was a gelatinous mass, which seemed to result from an alteration of the fibrous tissue. M. Cruveilhier has several times observed a similar alteration in the fibrous structure of the uterus. He could discover none of the natural tissue of the testicle, and believes that the fibrous tumour was formed at the expense of the cellular tissue which unites the seminal tubes, and that the proper tissue of the gland was atrophied from compression. In this case there was no microscopical examination, and no sequel is given. The latter especially is necessary to assure us of the real nature of the disease; for, in some instances, where the appearance and minute examination gave the impression of an innocent fibrous or fibro-cellular tumour of the testis, the favourable prognosis has been soon disproved by the appearance of malignant disease in other parts of the body.

Sir B. Brodie mentions the case of a man who had one testicle enlarged and hard. Though the symptoms were not those exactly of chronic inflammation, he treated it as such, and administered mercury without avail. The testicle was amputated; and the structure was found to be peculiar, like very condensed cellular membrane, of the consistence of ligament. Between six and twelve months afterwards an apparently similar disease began in the other testicle. Under the administration of iodine, internally and externally, the disease diminished.

These examples, and I know of no others more nearly approaching to fibrous tumour, are not sufficient to assure us that this disease really affects the testicle.

Mr. Paget† speaks of a “fibro-cellular tumour,” removed by Mr. John Lawrence, with the testicle, within the tunica albuginea of which it appeared to be entirely enclosed. The patient was a healthy-looking man, 37 years old; and the tumour had in seven years grown to a measurement of nearly six inches by four. When first removed, it was to the eye exactly like a fatty tumour, but it con-

* *Anatomic Pathologique*, 5^e livraison, pl. i. fig. 3.

† *Surgical Pathology* vol. ii. p. 118.

tained no fat, and was a typical specimen of fibro-cellular tumour in a very cedematous anasarcaous state.

CANCER OF THE TESTICLE.

Of the four varieties of cancer usually recognised by pathologists, the "encephaloid" is of very frequent occurrence in the testicle; a few examples of the "scirrhus" and "melanotic" form have been met with;* but I have not found one recorded instance of the "gelatiniform" cancer of this organ.

Encephaloid cancer presents much the same characters in the testicle as in other parts of the body. It commences most frequently in the glandular portion by the formation of small masses among the tubuli seminiferi. They gradually increase and coalesce, to the destruction of the glandular substance. Sometimes it begins at one point in the centre of the testicle, or in the rete; and the tubuli of the lobules are, at first, spread out over it. It has its origin less frequently in the epididymis. Mr. Wardrop gives a case where the tumour grew from the surface of the tubuli testis, immediately under the tunica albuginea, and Sir B. Brodie one in which the glandular structure of the testicle remained in a natural state, while there was a large fungous tumour completely occupying the tunica vaginalis.† It is only when the tumour is examined in an early stage that we can tell where it began; for all the structures soon become involved and destroyed by the disease, and the whole is reduced to a cancerous mass, in which none of the natural components of the testicle can be traced. The mass has a soft pulpy consistence and, commonly, a more or less uniform white or pinkish-white colour. When squeezed, a creamy fluid oozes from its cut surface at a multitude of points; and if a stream of water be directed upon it, the greater part is washed away, leaving a flocculent, filamentous, areolar structure, in the interstices of which the creamy fluid had been contained. It is usually so soft, and the areolar basis is so fragile, that it is liable to give way in consequence of a slight blow, or without any such cause, and blood becomes effused in its substance. This may take place at many points, interstitially, or into rugged cavities formed by the pressure of the blood; and

* Mr. Curling mentions two instances of scirrhus, and three of melanosis. The occurrence, however, of true scirrhus like the scirrhus of the mammary gland, is extremely rare, indeed is almost disproved by the more searching observations of modern pathologists.

† This case is related and represented by Sir A. Cooper. One apparently similar is given by Sir E. Home, *Obs. on Cancer*, p. 125.

the effused blood, undergoing changes, gives rise to a variety of appearances and discolorations. Sometimes the fibrous skeleton is thicker and tougher, giving a firmer consistence to the mass and simulating "fibrous tumour;" and it may be arranged in places concentrically, so that the more fluid elements appear as if they were arranged in cysts. Or there may be cystic disease combined with the cancer. It not unfrequently happens also that masses of cartilage are present; and this combination is more frequent in the testicle than in other parts of the body. In a case where the testicle had attained to very large size in a year from the time when enlargement was first observed, I found numerous small thin-walled cysts, containing clear serum, scattered throughout the encephaloid structure. They appeared to have been secondary to it, or to have grown together with it. In the middle of the tumour was a hard spherical mass, as large as an orange, composed of compact fibrous tissue with small cysts, some of which contained clear fluid, and others were filled with nodules of cartilage. From the short period during which the testicle had been enlarging in this case, it would seem that the several growths—cystic, fibrous, cartilaginous, and cancerous—had commenced and gone on together. The variety in them, perhaps, depended upon the different structures involved; the more solid elements originating in the mediastinum and rete, and the softer components in the glandular part of the testicle; just as we find cancer of the breast to be associated with a considerable development of fibrous structure, and cancer of the bones to be attended with a marked growth of fibrous and osseous tissue.*

Changes of a different kind, due to degeneration of parts of the growth, may also take place. Softening may occur, producing cavities filled with grumous, pultaceous substance; or the cells and tissue may become impregnated with oily matter, giving a yellow colour to parts. None of these changes are of much practical importance, or affect materially the progress of the disease.

Gradually the mass increases; not, however, quite steadily. There are often periods during which it seems to be quiescent;† or

* In most of the cases of combined enchondroma and encephaloma the two morbid products have not been blended, but, as in this case, the cartilage has formed a separate mass embedded in the cancer. The consecutive disease in other parts of the body has usually consisted of cancer unmingled with cartilage.

In specimen 2429A in the College of Surgeons portions of bone-like substance, resembling light osteoid tumour, are embedded in the mass. I do not know any other example approaching to osteoid cancer in the testicle.

† In a case which lasted more than five years, the slow progress was attributed to the process of retrograde metamorphosis in the centre of the tumour nearly

an actual temporary diminution of size may be caused by absorption of fluid effused during the earlier stages into the tunica vaginalis. The hope thus engendered is only destined to be soon dispelled by the rapid progress of the malady. The tunics of the testis yield under the pressure of the quickly increasing tumour more readily than might have been expected, and become stretched to a very great extent; so that although the tumour may attain to large size, they seldom give way. Sir A. Cooper speaks of the disease making its way through them and projecting as a bleeding fungus through the ulcerated skin; but as a general rule, before there is time for this to have taken place, the testicle has been amputated, or the disease has extended along the spermatic cord to the abdomen, the lumbar glands and other organs have become involved, and the patient has sunk under the depressing and destructive effects of the disease.

Cancer of the testicle makes its appearance at all periods of life, from the earliest infancy* to old age, but is most frequent from twenty to forty. It is rare after sixty.

Symptoms. Quickly progressing solid enlargement of the testicle, without inflammation, is the great, the almost infallible, indication of the disease. Whenever we can make sure, therefore, that this is going on, we may be pretty certain that there is medullary cancer. The enlargement is general, the testis and epididymis being usually blended at an early period. The part is at first rather firm; and the firmness is uniform, and the surface smooth. After a time the mass becomes softer, at some parts more than others, so as to have a pulpy, elastic, or fluctuating feel, tempting a lancet-thrust. It is not commonly very tender or painful. If there be pain, it is dull, not acute or lancinating. Pressure upon it, or any part of it, does

balancing that of growth at the circumference. *Trans. of Path. Soc.* vol. x. p. 205. In another case of similar duration the mass was firmer than usual. *Med. Times and Gaz.* vol. xx. p. 291. The following is given by Mr. Paget (*Surg. Pathology*, vol. ii. p. 394) as an example of arrest or suspension of the progress of cancer. "A man, 38 years old, had slight enlargement of one testicle for 15 years, and its rate of increase was often inappreciable. At the end of this time rapid growth ensued. On removal, well-marked medullary cancer was found, and was the only apparent source of the enlargement. He died soon after the operation with recurrence of the disease."

In a case related in the *Lancet*, Aug. 10, 1861. the tumour is said to have grown to the size of a new-born infant's head in sixteen weeks.

* In the College of Surgeons (No. 2401) is the section of a large medullary tumour from the testicle of an infant seven months old. It has been known to exist in several instances in children under two years. See microscopical examination of malignant tumours of the testicle, from boys æt. 5 and 3, in *Trans. of Path. Soc.* vol. xi. pp. 161 and 165. The tumour from the younger boy was judged from the examination to be innocent, "fibro-nucleated;" the sequel, given in vol. xii. p. 164, proved it to be malignant.

not elicit the peculiar sensation of the testicle being touched. The veins of the scrotum become turgid. The cord is free at first; and the vas deferens can be felt to be natural. Soon the cord becomes thick and full from turgescence of its vessels, perhaps thick and firm from deposit of medullary matter in it. As the disease progresses, the health suffers, the patient becoming weak and thin, with anxious expression. It is, however, important to remark that this alteration in the general health is by no means constant, or even usual, in the early stages, and that it has, therefore, no necessary connection with the malady, but is only a result of the effect of the malady upon the constitution. So much is said and written about cancerous cachexia, that cachexia comes to be regarded as a necessary associate of cancer. Hence Physicians and Surgeons rely upon it as a means of diagnosis, and conceive that a disease cannot be cancerous because the patient's health is good. Whereas, in reality, cancer, especially in early and middle life—the periods in which the testicle is most commonly attacked—fastens itself often, I would say oftenest, upon those who are well nourished and florid, who seem the most healthy and robust and, so, give promise of long life and vigour.

Although the diagnosis of medullary cancer may seem to be easy, the mistakes which frequently occur prove that it is not always so; and there are few Surgeons who have not been puzzled, and occasionally foiled, in distinguishing it from non-transparent hydrocele, hæmatocele, and cystic disease, and, in its early stages, from syphilitic disease. If a testicle, which has enlarged quickly, be solid, it is, in all probability, medullary; but the difficulty, in some cases, is to be certain that it is solid. The weight, the sense of fluctuation, and the history, will enable us to decide this point in many cases; but we often require the additional information afforded by a trocar or an incision. It is best to resort to the latter, as it affords the most certain information, and is the best treatment in those cases of hydrocele and hæmatocele that are likely to be mistaken for encephaloma.* The diagnosis from cystic disease may be based partly upon the rate of growth, but especially upon the information elicited by the trocar. It is not of so much importance, because the treatment is the same, whether the growth

* The amount of blood which flows through the canula of a trocar thrust into an encephaloid testicle is sometimes so great as to lead to the supposition that it must be a hæmatocele. It is to be remarked, however, that in such cases the diminution of the swelling is not so proportionate to the flow of blood as it is in hæmatocele.

be cystic or medullary, and, as has been already said, the two diseases are often combined. The point of most practical importance, and of greatest difficulty, is to distinguish cancer of the testicle, in an early stage, from enlargement caused by inflammation—simple, syphilitic, and scrofulous. The absence of the symptoms of inflammation is so frequent in inflammatory affections, that this negative symptom helps us very little; and our opinion is rather to be formed by observing the influence upon the swelling of those remedies which are usually of service when it is of inflammatory nature. If we find that the swelling does not yield to antiphlogistic measures, with mercury and iodine, but goes on increasing, we have reason to fear that it may be caused by some growth, malignant or other, in the testicle. The difficulties of diagnosis have been found to be very great when a retained testicle has been the seat of malignant disease.*

The disease usually terminates fatally in about eighteen months or two years;† and it does so less by the changes it induces in the testicle than by its effects upon distant organs and upon the constitution. Sometimes the inguinal glands are involved. More commonly it spreads up the cord into the abdomen, attacking the lumbar glands, and giving rise to the formation of masses which compress the vena cava and thoracic duct, destroy the bodies of the vertebræ, press upon the spinal cord or the nerves, or impair the action of the abdominal viscera. The most distant organs also become the seat of its ravages, particularly the lungs. Cancer of the lungs is not a very common affection; but I have observed it to occur more often as a sequence of that disease of the testicle than of other parts. It rarely affects both testicles.

Treatment. The removal of the part should not be attempted unless there be a fair prospect of taking away the whole disease. If it have spread up to the inguinal canal, or if there be a tumour in the abdomen, it is not worth while to subject the patient to an operation.‡ After complete extirpation, the prospect is no better than after similar operations for cancer in other parts.

* *Medico-Ch. Trans.* vol. xxx. p. 10.

† In *Med. Times and Gaz.* vol. xix. p. 258, two cases are mentioned in which the disease terminated fatally, without operation, four months from the time at which it was first observed in the testicle. Cases have been mentioned in footnote p. 595, in which life was prolonged to five, and even fifteen, years.

‡ It would seem that quite sufficient attention is not paid to this point. Of 36 cases collected in the *Medical Times and Gazette*, vol. xix. p. 258, three died within a week, and cancer was found in the lumbar glands; two died within six weeks; and two within three months of the operation. There was, in each, disease of the lumbar glands, or lungs, or both. In a specimen in St. Thomas's Museum the cord is healthy for an inch and a half above the testis, and then is expanded by enccephaloid disease, which was not discovered before the operation.

Indeed the tendency to secondary disease seems to be remarkably strong when the testicle has been the primary seat of cancer; so that the encouragement to surgical interference is not great; and the most that can be said is, that life may be prolonged thereby a little. One patient lived four years, under my observation, after the removal of a well-marked medullary testis, and died, as we believed, of phthisis; but a post-mortem examination was not obtained. Sir B. Brodie heard of one patient alive and well three or four years after the operation. Mr. Curling relates four cases in which the patients were well at the respective periods of 10, 4, 9, and 12 years after the operation; and quotes four others from Dr. Baring, of Hanover, in which considerable periods had elapsed without return. Mr. Cock mentioned the case of a man whose testis he removed for medullary cancer, who was in good health six years afterwards, and emigrated to Australia.*

CALCAREOUS, OSSEOUS, AND OTHER FORMATIONS.

Mention has already been made of the formation of calcareous flakes or masses in the testicle and its coverings. They are generally the result of the earthy impregnation of lymph or scrofulous deposits. It is not uncommon to find them in the tunica vaginalis as spots, streaks, or flakes, occupying, perhaps, a considerable part of the tunic. It may be in the form of fine sand on its surface; or there may be rough nodulated lumps in its cavity, consequent on changes taking place in lymph effused there. Sometimes they are in the substance of the testis or the epididymis; and the whole of the gland has been converted into an earthy mass. I am not aware that these deposits have been traced to a gouty cause, or that they have been found to consist of uric acid in combination with an alkali. Now and then the vas deferens has been discovered choked with earthy matter, or to have undergone calcareous degeneration in a greater or less part of its length.†

Bone, skin, hair, teeth. Like the ovary, the testicle is occasionally the seat of dermoid cysts, having much the structure of true skin, with cuticle, hair-bulbs, and sebaceous follicles, and containing the products of these structures, viz. epithelial scales in various states, hairs, and waxy or oily matter. Sometimes, in addition, masses of bone, with or without teeth, are embedded in the wall of the cyst; and there may be other solid matter, fibrous or cerebriform, with cavities containing fluid of various colours and consistence. The osseous masses, which may consist of true bone, are generally of irregular shape, and uneven on the surface; and the teeth, which may have crowns and fangs like ordinary teeth, are commonly

* *Med. Times and Gaz.* vol. xix. p. 287.

† Mr. Gamgee (*Surgical Researches*) has collected numerous examples of "calcification and ossification of the testicle and its appendages in men and animals."

crooked and disposed in a disorderly manner, quite unlike the teeth in a jaw. These tumours have, in most instances, been observed soon after birth, and are, probably, usually congenital. The rate of their increase varies a good deal. Sometimes they do little more than increase *pari passu* with the growth of the individual; or they may grow at a somewhat quicker rate; and they are liable to sudden accessions of increase, which may be due to an injury, and may be attended with inflammation. The inflammation has, in one or two instances, gone on to suppuration; and the bursting of the abscess has been attended, or followed, by the discharge of oily matter, hair, teeth, or bony fragments. In the greater number of recorded cases these masses appear to have been developed in the testicle; but it is not certain, from the description of other cases, that this was so; and in the one described by Velpeau the tumour could be dissected from the testicle, which was slightly atrophied.

In accordance with the views of Geoffroy Saint-Hilaire, these tumours have been thought by most pathologists to be due to "foetal inclusion;" that is to say, it is conceived that the more or less imperfect germs of a second foetus have become included in the testicle during development. It may, however, well be doubted whether such a process ever takes place; and the probability of its being the cause of the formations in question is, to my mind, very small. They are far more likely to be the result of departures from the natural formative processes in the testicle at a period when the developmental forces are in activity, and when morbid products are more prone to be composed of natural structures than they are when occurring at subsequent periods of life. Moreover, the peculiar function of this organ and of the ovary may predispose either gland, under certain circumstances, to the evolution of some structures which, in the natural course of things, should result from the combination of their secretions. The "*hétérotopie plastique*" of Lebert, in other words, the production of these structures by forces existing in the part, is, I think, more in accordance with other teratological and pathological phenomena than the "*inclusion*" theory of Saint-Hilaire.

The only treatment is extirpation, which should be performed if the tumour increases or is a source of inconvenience. The tumour is not likely to be of malignant nature, nor to be followed by any disease of that kind in other parts. In none of the cases which have been recorded, however, has the sequel been sufficiently given, to determine this point. It is quite possible that encephaloid disease may be engrafted upon it, and may have been, in some instances, the cause of the more rapid increase of size. In performing the operation, it should be remembered that the testicle may be free, and that

in one case (Velpeau's) it was left uninjured, though the patient died of purulent infection.*

The operation of castration is very simple and easily performed. Yet, to perform it well and to insure success, as far as possible, it is necessary to attend to some minor points. The incision, commencing at the external ring, should go quite to the bottom of the scrotum, so as to afford a drain for fluids that might otherwise accumulate in the wound.† It is seldom necessary to remove any skin; but, if it be desirable, a good deal may be cut away without interfering with the healing of the wound. The superficial structures having been reflected from either side, an assistant should hold the cord between his finger and thumb, to prevent its escaping into the inguinal canal after its division. This is most likely to occur when the testicle, being large and heavy, has dragged the cord down. A good deal of trouble has, in some cases, ensued from neglect of this precaution, it having been found necessary to cut into the inguinal canal in search of the cord; and this has been followed by peritonitis. When the testicle is not large, or when the cord can be divided at some little distance from the inguinal canal, there is no fear of its disappearing; and in such cases I have operated quite alone, without any assistance, and have experienced no difficulty. In dissecting out the testicle, the raphe of the scrotum and the penis are to be avoided. Some pains should be bestowed on the process of securing the blood-vessels of the cord and of the scrotum; for, unless this can be carefully done, there is liable to be hæmorrhage after the patient is in bed. I suspect that secondary hæmorrhage after operations may, in this and almost all operations, be prevented by properly securing the vessels at the time. The vessels of the cord should be tied separately. There are usually two, the spermatic and deferential arteries; there may be more. It is a bad practice to include the whole cord in one ligature; first, because unnecessary pain from tying the nerves is likely to be so caused; secondly, because it is never safe to include much tissue in the knot with an artery. When this is done, it is probable that the division of the inner coats of the artery by the thread, which conduces much to the closure and healing of the vessel, may not be effected; and then, after a few days, the included tissue, softening and becoming absorbed, may leave the ligature loose and the vessel free to bleed. I have several times attributed, and I believe correctly, secondary hæmorrhage to this careless mode of tying vessels.‡ The interior of the wound should be roughly

* Dr. Verneuil (*Mémoire sur l'inclusion scrotale et testiculaire*, republished from the *Archives générales de Médecine*, Juin 1855, et suivants) describes one case, and has collected nine others. He advocates the inclusion-theory very strongly, arguing much from the resemblance of some of the products to bones and other parts of a fœtus. In considering such a question, however, we must take the observations with some reserve, and must make some allowance for the imagination of anatomists and pathologists, which has always shown itself remarkably fertile in resemblances of that sort. Similar tumours have been found in the horse's testicle by the late Mr. Bowles of Cambridge. Indeed, I believe structures of this sort—natural structures—are more liable to be developed abnormally in the lower animals than in man.

Tilanus (Schmidt's *Jahrbücher*, c. 171) describes a congenital cysto-fibroid of the testicle, removed from a man æt. 20, containing hair, sebaceous glands, well-developed cartilage, and bone.

† To secure better drainage, Aumont proposed to make the incision along the hinder part of the scrotum instead of in front, and the plan has been adopted in England; but it must be attended with some inconvenience and is not necessary.

‡ In a case where hæmorrhage ensued profusely an hour after tying the cord *en masse*, and other expedients failed, the bleeding was finally arrested by a large Signorini's tourniquet applied so as to compress the cord on the pubes. *Med. Times and Gaz.* vol. xiv. p. 339. The écraseur has been used to divide the cord, but is

sponged, over and over again, to remove clots and cause the vessels to bleed; and all that do bleed with any briskness should be tied. The Surgeon should endeavour to tie them all at the time of the operation, and should close the wound while the patient is under the influence of the chloroform. It is often recommended to leave the wound open for a few hours, because of the probability of hæmorrhage. This plan tends to make the Surgeon less painstaking in tying the vessels; and, when it has been followed, I have often found that bleeding has occurred, and it has been necessary either to administer chloroform again, or to put the patient to much pain in securing the vessels and closing the wound. The edges of the skin should be approximated with sutures; and no other dressing of any kind should be applied, no plaster, no compress, no bandage. For many years I have followed this plan in the treatment of wounds after operation, with very few exceptions, after amputation, hernia, breast-excision, &c., leaving the wound quite uncovered, and have made some efforts to impress upon others the advantage of it. I am glad to find the practice is being adopted in some hospitals, and feel sure that in time it will be universal. No dressings being applied, there are none to be removed and reapplied; the wound is kept cool, and can easily be kept clean and pure, and discharges find a ready escape. If any thing goes wrong, it is at once detected, and the removal of a stitch or slight opening of the wound will give vent to matter and relieve the part; or a poultice may be applied. A poultice is better than lint under oil-silk, being softer, and adapting itself more completely to the inflamed surface. The general treatment must depend upon the habits and requirements of the patient in each particular case. I never operate upon a florid, robust person—especially after middle life—if I can help it, without some previous preparation by aperients and regulated diet; and believe that by this precaution erysipelas, so-called pyæmia, and other ill consequences, may often be prevented.

The Surgeon should ascertain whether there be hernia on the side to be operated on, and, if there is, the extent to which the sac descends upon the cord; and he must be careful not to interfere with it. It may be necessary to dissect the cord from behind the sac. I was fully impressed with the need of caution in this particular by finding, after the operation of castration had been performed on the dead subject in lecture, that the lower part of a hernial sac had been removed with the testicle. Sir E. Home relates a case in which the dressings were forced off by a protrusion of the intestines during a fit of coughing.*

A fatal result has not followed in many cases, and in some of these it might have been prevented. For instance, it has resulted from hæmorrhage in consequence of retraction of the cord before the vessels were secured, and from peritonitis occasioned by searching after the retracted cord. More frequently the cause of death has been erysipelas,† or suppuration in other parts of the body (pyæmia).

not to be preferred to the plan of cutting it through and tying the vessels separately. Moreover, experience tells us that, though bleeding may not occur at the time, it is liable to take place a few hours after the use of the *écraseur*.

* Mr. Curling, "removing a large carcinomatous testicle, accidentally opened. In dividing the spermatic cord, a hernial sac containing a small piece of omentum, of the existence of which he was not aware. A compress was applied at the groin, and no ill effect followed."

† Two fatal cases from erysipelas are reported in the *Med. Times and Gaz.* vol. xix. p. 256. In both there was malignant disease of the lumbar glands. Of 36 cases of castration for malignant disease reported in that journal, 26 recovered; the number of deaths was greatly dependent upon the invasion of other organs by the disease, and the consequent cachectic state of the patients: the proportions of recoveries when the disease was not malignant was 26 to 1: a low form of phlegmonous erysipelas was the cause of death in the one fatal case.

FUNCTIONAL DISORDERS OF THE TESTICLE.

An interesting and important, though difficult and rarely discussed, point in physiology is the relation of the generative apparatus to the moral character, and the degree in which the former is subservient to and regulated by the latter. I think it would be found that it is so to a very great extent, to a greater extent, perhaps, than is usually recognised; and it is desirable that practical men should pause awhile upon a question of this sort, and not hastily commit themselves to opinions which may have much influence upon the well-being and happiness of society. There are no organs so much under control as those of generation. Their functions are neither directly nor indirectly, in the least, essential to life, scarcely even to the well-being of the body; indeed, which is more remarkable and unusual, they are scarcely essential to the maintenance of the structure of the organs themselves in perfect integrity. The functions of the testicle, like those of the mammary gland and the uterus, may be suspended for a long period, possibly for life; and yet its structure may be sound and capable of being roused into activity. In this respect its qualities peculiarly adapt it for subserviency to man's moral nature. Not that it yields a tame and easy submission. By no means. That stern struggle between the moral and the physical is one of man's greatest trials; a trial which it may be presumption voluntarily to encounter, yet a trial which is, at some time or other, laid upon most men; and it is some satisfaction to know, that if the victory be with the moral, it is not necessarily at the expense of the physical. It is, perhaps, partly with the view of giving strength for this control, or rather of disarming the antagonist, that the advocates of celibacy among the clergy are usually the advocates also of stringent and regularly repeated fastings.

The earliest and most frequent cause of disorder of the generative apparatus is the practice of self-abuse, the tendency to which is strongest about the age of puberty. At that time there is considerable excitement about these organs, increased, perhaps, by the conversation and thoughts which are indulged in; and it is apt to be unchecked by the moral control, which has not yet acquired its proper influence. Moreover, lads are often induced to the pernicious practice by their companions, who may be as ignorant as themselves of the wrong and mischief they are doing. It would be a very good thing if those who have the charge of boys were less scrupulous in giving warning upon this matter. Much trouble and anxiety might be spared by timely advice seriously and kindly

given. From no one could this come better and with more authority than from the medical attendant, who often has, or may find, an opportunity of giving a hint in time; and, if I am not much mistaken, his kindness will generally be well appreciated. An extensive acquaintance, through years, with those who have just come from our schools, has impressed the importance of this matter upon me. Often, unfortunately, the habit is commenced at an earlier period than I have mentioned, as early, perhaps, as the age of ten or twelve. The pernicious effects are evinced *first* in inducing a weakness and irritability in the organs themselves, with nocturnal emissions, or emissions occurring during the day under slight excitement, imperfect or transient erections, premature ejaculation seminis, &c.; *secondly*, in a general enfeeblement of the frame and disorder of the various functions, in indigestion in some of its many forms, palpitation of the heart, nervousness and impairment of the mental vigour, epileptic and amaurotic symptoms, or even paralysis; *thirdly*, in its influence on the character, in a lessening of the moral courage and the engendering a tendency to shyness, hypochondria, reserve, and solitariness. The mind becomes engrossed with the one subject; and this unfits it for high thought and bold resolve. The man is lowered in his own estimation by the consciousness of yielding, or having yielded, to a secret habit, and is haunted by the thought of the mischief he has entailed on himself. He seeks the advice of a medical man, yet shrinks from divulging the real cause of his maladies, while he excites suspicion of it by his fidgety absent manner and downward glances.

The symptom about which we are most frequently consulted is nocturnal emissions. The occasional occurrence of these is of no consequence; and the patient may be assured to that effect; but when they return more than once in a fortnight, and especially if they amount to two, three or more, in a week, as is sometimes the case, they should receive attention. According to my own experience they are much more frequent in the middle and upper, than in the lower, ranks of life, and especially in those who are of studious and sedentary habits and are anxious respecting the result of their studies. They are often associated with indigestion and turbid urine. They cause prostration both of body and mind, aching in the lower limbs and back, sometimes a flow of light-coloured urine and irritability of the bladder. They are a source of great mental anxiety. This is increased greatly by the perusal of publications upon the subject, which are freely circulated among young men for the purpose of rousing their apprehensions and

inducing them to resort to the authors of these publications, by whom their worst fears are confirmed, and incredible sums are abstracted for promised cure. Hence I commonly find that to the real effects of the malady are superadded others more or less imaginary suggested by what has been read, such as loss of memory, inability to fix the mind upon any subject, palpitations, dyspnœa, &c.

Treatment. The attention to these sensations, real and imaginary, and the constant dwelling upon the matter, tends, unquestionably, to aggravate the malady. My first effort, therefore,—having requested the patient to burn any book or pamphlet he may have upon the subject,—is to restore a calm and less anxious frame of mind by assuring him that great part of his apprehensions are groundless, giving him good hope of recovery, in great measure at least, recommending him to engage in out-door amusements and to enjoy the cheerful society of his friends, not to relinquish his reading, but to work less hard at it, especially towards night; to go to bed early and rise early. I am unwilling to keep up the idea of invalidism by prescribing medicine or particular diet, and simply warn him against overloading the stomach, as that is likely to induce the discharges. These assurances and simple directions are often sufficient; and many have told me of the relief and happiness they have derived from them. This failing, and in worse cases, more particular attention must be paid to the digestive organs and their secretions, especially when the urine is turbid; mild aperients may be required to prevent accumulations in the intestines, and a light diet must be enforced. In those who are robust an alkali may be given at night; and in those who are weak, quinine or steel. Better than all medicines are relaxation from work with change of air, travelling, and sea-side residence. Often, however, these cannot be carried out, or are available only for a time; and under the medicinal treatment the discharges are sometimes not sufficiently diminished. Perhaps the intervals between them are lengthened; and they return two or three nights in succession, instead of being more frequent and with more regular intervals. I have not found cold ablutions do much good; though washing the exterior of the glans penis, and keeping it clear of secretion, is of some service by lessening the irritability of that part.

The application of nitrate of silver, by means of the *porte caustique*, to the hinder surface of the prostatic part of the urethra, where the ejaculatory ducts open, is unquestionably, in some cases, an efficient adjuvant to the means just described for checking or moderating this malady. It has been employed by many persons since it was brought prominently into notice by Lallemand; and I do not know that mischievous results have attended its use in competent hands. Care should be taken that the instrument is sound, for the solder connecting the part which carries the caustic is liable to be decomposed. This once gave way, leaving the end of the instrument and the caustic in the prostate of a gentleman whose urethra I was cauterizing. It was voided with the urine in the course of the following day; and, though he suffered more than was intended, no evil resulted. The caustic may be applied pretty freely, the instrument being known to be in the prostatic region by the distance to which it has been passed, and by the sensitiveness of the part, or, more certainly, by feeling with the finger in the rectum. A good deal of irritation, pain, with frequent bloody micturition and some discharge follow the operation, with, perhaps, seminal emissions at night. These subside in a few days, and the good effect is, at once, shown by a cessation of the emissions. In many cases, however, they return after a period, requiring a repetition of the remedy, perhaps two or three times; and in some cases no good results from it. I am aware that this proceeding is objected to by some whose opinion deserves attention as unsafe, by others as empirical, and by others as unphysiological and unpathological. It can scarcely be regarded as

unphysiological, when we observe the effect which is produced on the whole length of a tube or a series of tubes by irritation at any one part of the lining membrane, especially if that part be near an orifice; how titillation of the fauces will cause vomiting, or of the larynx coughing, or of the rectum diarrhoea and tenesmus. It cannot be very unsafe or even injurious, or we should ere this have heard of more ill-effects produced by it. Neither do I think it so empirical and unpathological as some seem to regard it, mistaking, as I cannot help fancying, the real seat of the malady, which appears to me to be in the prostatic part of the urethra more distinctly than in any other portion of the generative apparatus. I judge this to be so, because there is usually a preternatural sensitiveness of that part elicited by the passage of instruments, or by pressure with the finger. Frequently there is uneasiness or actual pain there, especially after the emissions; and an irritation of this part by any cause is likely to induce the emissions.* It is the only part in which any thing distinctly abnormal in the sensations is experienced; the testes, vasa deferentia, vesiculæ seminales, show little or no tenderness or other sign of disturbance. We are, therefore, warranted in considering this part to be at fault, and in applying to it that salt which is often found to allay irritability or a chronic inflammatory condition in other mucous membranes. Above all, there is the more cogent argument that good frequently results from its use. We must not, however, be too sanguine in our expectations, for, as has been already said, the benefit is sometimes only temporary, and in some cases the treatment fails altogether. In some slight cases benefit is derived from the occasional passage of a metallic instrument into the bladder.†

Accompanying this malady, or independent of it, there is sometimes a discharge from the urethra of tenacious fluid, like white of egg, in small

* In each of three aggravated cases examined by Lallemand and Curling, "the mucous membrane of the prostatic part of the urethra was swollen and injected. The prostate was nearly destroyed, and converted into a multilocular abscess, or a number of alveolar cells, communicating with each other; and the diseased mucous membrane covering it was riddled with holes, formed by a considerable enlargement of the original orifices of the gland, through which pus or altered secretion freely escaped on pressing the prostate." "One or both vesiculæ seminales were infiltrated with pus, and their walls thickened by inflammation. The orifices of the ejaculatory ducts were enlarged and abraded." Curling, *On the Testis*, p. 391.

† *Castration in erotomania.* The following note from Dr. Bell upon this subject in the *Boston Medical Journal*, vol. lxi. p. 166, and *Med. Times and Gaz.*, gives a just estimate of the effect of the operation in these and the allied cases for which it has been proposed. It is occasionally successful, but often does no good. "I have often been consulted as to tying the spermatic arteries, the vasa deferentia, and removal of the testes, in the forms of insanity connected with spermatorrhœa. I have known it done repeatedly. In one case Dr. — castrated a clean-gone onanist, who subsequently rallied, became an active man; and the doctor told me that he never met him that he did not receive his blessing for the great favour that he had conferred on him. In another case of self-perpetrated castration under a similar state of mind, entire restoration to peace of mind and energy was produced. On the other hand, in all the Lunatic Hospital cases where I have known it done, no valuable results have followed. At the Ohio Hospital, some years ago, it was tried on quite an extensive scale. No case of improvement followed; indeed, Dr. Aul told me that in one patient, who previously was quiet and contented, a permanent and dangerous condition of irritability followed." These remarks correspond with the result of Mr. Holthouse's case read before the Medico-Chir. Society, March 22, 1859. In that case the epileptic seizures returned as before the castration. It should be remembered with reference to the operation in these and similar cases, that the fluid emitted is not formed, altogether, by any means, by the testes, but merely acquires its fecundating qualities from the secretion of the testes; and that, therefore, the immediate object intended by the operation—the prevention of emissions—really is not effected in many instances, at any rate for some time after the operation. The emissions are not dependent upon the testes, but upon

quantity, following the urine, or expelled during the evacuation of the fæces, especially when straining is required for that purpose. This symptom causes great alarm to the patient, as he conceives that he is suffering from a continual escape of the semen. Such, however, is not the case. I have examined this fluid passed by several persons, and have never found any spermal elements in it. It proceeds, apparently, from the prostate gland; and its presence in sufficient quantity to issue from the urethra is an indication of a relaxed condition of the ducts of the gland, permitting the secretion to be expressed during the voiding of the urine or fæces. It generally ceases or diminishes under a tonic regimen and attention to the state of the bowels.

The same trains of symptoms which follow the noxious habit just mentioned may be induced by excessive indulgence in venery, though they are not often so enduring, or attended with so much mental depression. They are not uncommon, in greater or less degree, soon after marriage. They occasionally result also from gonorrhœa, when the inflammation has extended to the hinder part of the urethra, and left a morbid irritability there. The general plan of treatment is much the same, whichever may have been the cause.

The commonly-received opinion that the debility and other symptoms experienced in these cases is due chiefly to the loss of spermatic fluid is a mistaken one; forasmuch as the exhaustion consequent on the emission bears very little relation to the quantity of the fluid discharged, or to the amount of spermatic elements contained in the fluid. As the disorder progresses, and the emissions are more frequent, the proportion, indeed the actual quantity, of spermatozoa decreases, the discharge consisting chiefly of the secretions of the vesiculæ seminales and the prostate gland. The drain upon the system is rather through the nervous system than through the testicle; and the exhaustion experienced after each occasion is consequent upon a loss of nervous force rather than upon a loss of the secretion of the generative organ.

The question of impotence, with its contingent,—the unadvisability of matrimony,—is one on which it is difficult to write, inasmuch as there is not much very definite to be written. In deciding it, it is usually necessary to allow a considerable margin for the nervousness of the patient. A quiescent state of the organs, consequent on long control over the passions, is not to be regarded as an obstacle, because they may be roused into activity when appropriate circumstances arise; and after a long continuance and frequent repetition of nocturnal emissions, the organs usually retain sufficient vigour to admit of improvement under the influence of matrimony. It has happened to me often to be consulted on this subject; and I have very rarely felt it necessary to give a discouraging opinion. In the case of one gentleman, who from early life had been subject to very frequent emissions, who had long ceased to have erections or desire, and whom a variety of treatment, including cauterization of the urethra, conducted by different persons, had failed to give relief, my advice was that he should remain a bachelor. Very soon afterwards he married and had a family. It has been recommended that in doubtful cases the *experimentum* should be made *in corpore vili*. This appears to me to be useless as well as wrong; for the experiment thus made as a test

an irritable state of the genital organs; and they may continue, and be as prejudicial, although there be little or no semen in the fluid evacuated.

Mr. Chapman (*Med. Times and Gaz.* vol. xviii. p. 377) gives the case of a great sufferer from seminal emissions, with failing health, palpitation, dimness of vision, &c., who had one testicle removed in 1840, and the spermatic artery of the opposite side tied and divided, and more than an inch of the vas deferens removed in 1841, without benefit. Three months after the last operation the remaining testicle was removed. In 1848 he felt himself far better in all respects than before the operation; his eyesight was excellent; but he still was feeble, had weakness in the loins, and was a great sufferer from indigestion and low spirits.

is no real test, and, as might be expected, has ended in disappointment. I know a gentleman, in every respect, as I believe, well qualified to be a husband, and at one time anxious to be so, who has been prevented from marrying by the failure in this test, to which he, most reluctantly and needlessly, assented in deference to the advice of an eminent Surgeon whom he consulted. The indications derivable from external appearance are of little value; and suspicions based upon them have repeatedly proved to be groundless. There are certain obvious disqualifications, such as imperfect formations or diseased conditions of the necessary organs, and an entire absence of erections or desire. Where such disqualifications exist matrimony is rarely contemplated. Where they are absent the Surgeon is seldom justified in giving an unfavourable verdict; the instances being few in which, by judicious treatment, the patient may not be fitted for matrimony.

To the encouragement to matrimony it is well to add the hint that though, for various reasons, the rite may not be at first consummated, yet that, in all probability, it will be so before long. This may prevent unnecessary disappointment or despair. I have known premature separation carried out, indeed hurried on by the medical man, when there is reason to think that a little management and patience might have resulted in a happy union. The whole of this question is fraught with so much anxiety and excitement to the person concerned, that the mind is liable to be thrown off its balance, and the most deplorable consequences to ensue. In some cases, doubtless, there is cause for the anxiety; but in many the apprehensions are groundless; and happy is it if a man when thus racked with doubts can bring himself to make a confidant of, and disburden himself freely to, some judicious medical adviser, who will calmly enter into his case and acquire his confidence, who will assure him that such cases are not uncommon, and will, perhaps, give him the often-quoted recommendation of Hunter,* to make up his mind to abstain for a time. In all such cases it is necessary to take the general state of the health into account; for any debilitating cause, such as dyspepsia, diarrhoea, mental anxiety, &c.,—especially when there are phosphates or oxalate of lime in the urine,—is liable to be attended with inability, which may be only of temporary nature, and will yield to appropriate treatment.

As a general rule, in the healthy person, the recurrence of desire and power decreases gradually with advancing years. Sometimes it does not cease till a late period. This, however, varies much. In those who have abused the organs or indulged their amorous propensities to excess in early life, the cessation takes place sooner than in others. We learn that the lords of the harem are not unfrequently impotent at thirty or forty; and in this country the same occurs to persons who have been addicted to excite the organs preternaturally by giving way to lascivious thoughts, and in other ways. Any debilitating influence, whether it be mental depression or enervating bodily disease, indigestion, phthisis, diabetes, &c., produces more or less of the same effect; and it has been remarked by Mr. Curling that the "testes of persons who die of chronic lingering diseases are almost invariably soft and inelastic. When incised, their internal structure seems to contain but few blood-vessels, is pale, apparently shrunk and dry, and the little fluid that can be squeezed from it is destitute of spermatozoa."† It seems also that long-continued continence induces an earlier cessation of the capability of function than does moderate indulgence. And after long disuse the attempt to rouse these organs into activity at a late period of life, even if successful, is not altogether without risk to the general health. The excite-

* *Treatise on the Venereal Disease*, p. 203.

† Mr. Gulliver (*Med.-Chirurg. Trans.* vol. xxvi. p. 93) finds the seminal tubes in old age and after lingering diseases "often more or less obstructed by fatty matter, which occurs in free globules, and in more equally-sized and minute molecules, aggregated into comparatively large rounded or irregular masses, nearly opaque, and of a brown or dull-yellowish colour."

ment consequent on it is liable to induce much prostration, which may be followed by paralysis, amaurosis, affection of the heart, or other disorders. I suspect there is foundation for the remark that these ill effects are more likely to occur in the case of widowers marrying after a considerable interval, than in those who have not been before married. "Sexual indulgence late in life seems also to promote the enlargement of the prostate gland; and I know of several instances of old men being attacked with retention of urine from congestion of this organ, occurring after coition."^{*}

A moderate indulgence in sexual intercourse, especially when the affections are involved, tends to promote the general health and vigour. There are cases, however, in which even this cannot be borne, and in which the nervous exhaustion that ensues warns that abstinence is necessary. I know an instance in which an apparently healthy man, æt. about 45, suffered so much depression, with staggering and partial loss of vision, after each connexion with his wife, that, being unable to restrain himself, he urgently demanded and submitted to castration. He lived many years afterwards in the enjoyment of perfect health, and in the conviction that the mutilation to which he had submitted had been the means of preserving his visual organs, if not of saving him from general paralysis.[†]

Impotence sometimes follows injuries of the head. Cases of this have been collected by Mr. Curling,[‡] who remarks that when it depends upon that cause "the prospect of relief is far from being promising. The event itself is one of the last to be detected, and is rarely perceived till all treatment of the injury has ceased, and the patient is in progress of recovery. In some instances it is first announced by the visible wasting of the testicles. When otherwise, however, the Surgeon must not despair of the patient regaining his sexual powers as the other effects of the injury disappear." Sometimes it is the result of cerebral imperfection, as, occasionally, in idiots, or of some congenital deficiency of that combination of forces which is requisite for so complicated a process. This constitutional impotence is not necessarily associated with any discoverable imperfection in the organs, or any obvious defect in bodily formation. Indeed, it may be associated with full intellectual vigour, and a physique, in other respects, sound and strong. Such cases are, however, rare. The external indications of virility do not often continue when the power is actually and irrecoverably gone.

ATROPHY OF THE TESTIS

has already been several times alluded to in the preceding pages,

^{*} Curling, p. 370.

[†] I may add that for a year or more this gentleman continued, as in the instance recorded by Sir A. Cooper, to have connexion with his wife and emissions much as before the operation; so that his wife was not aware of any change till he informed her of what had been done. After about a year desire gradually ceased. The good effect here commenced, although the excitement and emissions continued after the organs were removed. Another man who had lost both testes told me that loss of desire and power followed very soon.

[‡] *Diseases of the Testis*, pp. 63, 364.

with the remark that it does not usually take place although the function of the organ is long suspended, or, even, when it has been lost in consequence of obliteration or destruction of the vas deferens. Neither is it commonly produced by the pressure of hydrocele; although it sometimes is caused by the contraction of lymph effused in chronic hydrocele, or, more frequently, of the lymph effused in hæmatocele. One of the most common causes of atrophy has been stated to be acute or chronic inflammation—spontaneous, syphilitic, or from mumps—of the glandular substance of the testicle, with effusion of lymph, or pus, into the intertubular tissue; the tubules being compressed and destroyed by the effused products both during their formation and during their subsequent contraction. The same result may follow excessive venery, drinking, self-abuse, or any thing which is productive of long-continued depression and disorder of the general health; also injuries of the head, paraplegia, and elephantiasis of the scrotum. Although injury to the duct produces no effect of the kind; yet, as we might expect in the case of an organ so peculiarly circumstanced with regard to its circulation, deriving its blood from a long distance through a single channel, and having very few anastomosing currents to fall back upon, it is very sensitive to any impairment of its vascular supply. Thus Wardrop relates that both testicles were absorbed in a man who died of an aneurism of the aorta, obliterating the spermatic arteries; and ligature of the spermatic artery will cause complete wasting of the gland. Varicocele also is sometimes attended with an impairment of the nutrition of the testis; and operations obliterating the veins in varicocele have been known to produce the same result.

In elderly persons I have found the testes rather small and flaccid, but in other respects healthy, with sometimes thickening and induration of the epididymis and thickening of the vasa deferentia with opaque white spots in their walls.

IRRITABLE AND NEURALGIC TESTICLE.

About the period of puberty the testicle is frequently tender and irritable, so as to be pained by a slight touch or by the chafing of the trousers in walking. It does not swell or present any indications of inflammation, but is a source of a good deal of annoyance, necessitating confinement from active exercise and out-door amusement. This condition usually subsides in a short time, and may be relieved by a suspensory bandage, or an evaporating lotion if the part be hotter than natural. The same condition may occur at other

periods of life, more particularly in persons of delicate, sensitive, and irritable temperament, or in those who have been addicted to self-abuse. It has occasionally proved a very obstinate affection, and has been a source of so much distress to the patient as to lead him to beg for removal of the organ. Sir A. Cooper was induced by the urgent request of the patients to perform castration in three cases of the kind; and other Surgeons have done the same. Such a procedure is, however, warranted only by very exceptional circumstances. Usually the malady subsides under attention to the general health. It is necessary to inquire into minute particulars respecting the state of digestion, the action of the liver and bowels, the character of the urine, the action of the skin, &c.; for where there is a tendency to irritable testicle, slight disturbances of other organs will induce it. To rectify any thing wrong that may be discovered in these functions is the first point. Secondly, it is necessary to improve the general state of the health by out-of-door exercise as far as possible, by moderately nutritious diet, and, perhaps, tonics. Some good may be effected by local applications, cold sponging, a suspensory bandage, or anodyne applications.

Neuralgia may occur in the testicle from the same causes as in other parts; such as a source of irritation in an adjacent region, a stone, or other disease, in the kidney, ureter, or other part of the urinary apparatus, varicocele, a disordered state of the stomach, liver,* or system; or a depressed condition of the health, especially if that be associated with malarious influence. In the latter case the pain usually comes on periodically. The organ itself may be quite sound.† The pain varies in character and severity, being sometimes dull, at others darting and so severe as to cause the patient to roll on the floor in agony and covered with perspiration.

The treatment will be the same as for neuralgia in other parts, varying with the exciting cause and the state of the health. When it is periodic, quinine or iron are likely to be beneficial. Of local measures, the hypodermic injection of a small quantity of strong solution of morphia into the testicle or the tissue immediately in-

* Sir B. Brodie (*Med. Gaz.* vol. xiii. p. 621) mentions the case of a gentleman in whom the neuralgic pains were usually preceded for two or three days by clay-coloured evacuations, pains in the head, &c. In another case there was a small projection of the epididymis; and whenever this particular part was touched he felt a sensation which he compared to that produced on biting on the exposed nerve of a tooth.

† That it is not so always is proved by the case mentioned at page 577, where a small quantity of pus was found in the epididymis. In a case related by Mr. Ludlow the patient, æt. 20, had neuralgia for six years, originating in an injury. Mr. Stanley excised the testicle; the tunica vaginalis was thickened and adherent, and the epididymis changed into a firm white substance.

vesting it, offers the best prospect of success, if we may judge from its effects in relieving neuralgia in other parts.

Varicocele. The disposition of the spermatic veins to enlarge is such as to cause varicocele in about one male adult in ten. It is due to several causes:—to the size and winding course of the veins near the testicle; to their numerous anastomoses, here and in the lower parts of the cord, which interfere with the efficiency of the valves, and enable fluid injected into them to pass readily from above downwards; to the loose inelastic tissue in which they lie affording them little support; and to their passage through the oblique inguinal canal, where they are frequently subjected to pressure during the action of the abdominal muscles; and to the length and comparatively small size of their efferent trunks. The causes usually assigned for the predisposition to varicocele on the left side being so much greater than the right—viz. the slightly lower position of the left testicle, the angle of junction of the left spermatic vein with the renal, and its relation to the sigmoid flexure of the colon—do not seem to me quite sufficient; but I have none other to suggest.

The disease consists simply in an increase of the size and tortuosity of the veins, with a loss of elasticity and contractility, and more or less increase of thickness of their coats; the latter change depending upon an addition of low fibrous tissue, which usually accompanies the enlargement of vessels and the diminution of their elastic and contractile elements. They may be further thickened by chronic inflammation, and the formation of lymph in their coats; and phlebolithes are sometimes found in their interior. The degree of enlargement varies much. It may be so great as to fill the scrotum and conceal the gland. This is, however, rare. It is greatest near the testicle, diminishes towards the inguinal canal, and ceases in the canal; so that the spermatic vein at and above the internal ring has its natural size. At least that has been so in the cases I have dissected. The affection is rarely productive of any decidedly injurious effect upon the testicle; though, when there is any great dilatation of the veins the organ is often somewhat smaller than that on the other side; and in a few instances it has been so wasted as to be scarcely distinguishable through the scrotum.

The affection, usually, commences at about eighteen or twenty, and often is not recognised till the swelling attracts attention. It may be induced or aggravated by sudden exertion or straining at stool, by long walking, or standing, or riding.

It is easily known by the feel of the soft worm-like coils of di-

lated veins near the testicle and extending to a variable point above it. The swelling is inelastic, increases after long standing, and towards the end of the day, and diminishes in the recumbent posture. There may also be a slight impulse on coughing. In these respects, and in its position, it resembles hernia. Still, had I not known a case in which one of the most eminent Surgeons in the metropolis made a mistake between the two affections, and persevered in it, I should scarcely have thought it worth while to say a word respecting a difficulty of the diagnosis between the two affections. The feel of the swelling, its slow and incomplete disappearance when the patient lies down, although the inguinal ring is quite free, and its reappearance in the erect posture, although moderate pressure is maintained upon the canal, furnish sufficient means of distinction. The skin is often thin, so that the dark colour and the outline of the dilated veins may be seen through. The affection is usually devoid of pain and tenderness. Sometimes, especially when it first appears, or when the patient's attention is first directed to it, it is attended with a sense of weight or uneasiness, or it may be actual pain; and it may be tender, and a source of much discomfort. As in the case of varix of the lower limbs, there are times during which, without perhaps any obvious reason, the swelling increases; and at these times there is liable to be more pain than at others.

Treatment. In the greater number of cases the swelling attains a certain moderate size, and then ceases to increase or to be the source of any pain, inconvenience, or detriment to the organ. It is not usually, therefore, necessary to adopt any treatment, and scarcely worth while even to use a suspensory bandage. The patient may not be conscious of the existence of the varicocele, or will, probably, soon forget it. During the periods in which it is uneasy, painful, or tender, the part should be supported by some kind of bandage, the recumbent posture should be maintained as much as possible, and regular action of the bowels insured. A spirit-lotion applied, as in cases of epididymitis, will also give relief. When the discomfort continues, it is necessary to try other means, such as washing with cold water, attention to the general health and state of the bowels, light clothing about that region. These failing, a portion of the scrotum has been excised in some instances, it is said, with success, but in others with only temporary relief, so that this is scarcely to be recommended. The less severe plan of lessening the scrotal bag by drawing a portion of it through a ring made of soft silver and covered with wash-leather, and then preventing its escape by pressing the sides of the ring together,* may be tried; for, if it fails, no harm will have been done.

The best means of affording relief in troublesome and painful cases of varicocele is a well-adjusted truss with the pad upon the external ring. It should press with a moderate amount of force, so as to influence the spermatic veins, diminishing their calibre, and preventing a sudden reflux of blood during exertion and straining, but not so as to affect the artery. The trusses which buckle round the waist, with a pad secured upon the part by

* Suggested by Mr. Wormald in his lectures, and in *Medical Gazette*, vol. xxii. p. 194.

means of an under-strap, answer, in some cases, better than the spring trusses, being less liable to displacement. The benefit afforded is often greater than might have been expected. Mr. Curling gives instances in which the varicocele was quite cured after the truss had been worn some months, and in which the testicle, partially atrophied before the treatment began, regained its natural size. In other cases it fails, owing, perhaps, to the difficulty of keeping the pad properly applied.

Various plans for obliterating the veins have been tried, such as compression by forceps fixed on the scrotum, division with the knife in the ordinary way and subcutaneously, ligature by means of needles with thread twisted in figure of 8, and subcutaneous ligature; also ligature and incision combined. The incision and the ordinary ligature have been discarded on account of the serious results that occasionally ensued. The best modes appear to be Ricord's subcutaneous ligature,* and the subcutaneous ligature at two points, the veins being subcutaneously divided between them, as effected by Mr. Lee. Each of these measures has led to great relief, or a cure, in several instances; and I do not know that any fatal results have occurred. In some cases no good has followed. It must be borne in mind that all plans for obliterating the veins are liable to be productive of impairment of the nutrition of the testicle; and, accordingly, we find that, in some instances, atrophy of the organ has followed the operation. This may have been caused by the inclusion of the spermatic artery in the ligature, an accident that cannot always be avoided, and the liability to it constitutes an objection to the several operations; but the veins are also essential, and if all, or nearly all, of them be obliterated, it is clear that new currents must be established, or the circulation, and consequently the nutrition, of the organ will be impaired.† For this reason, therefore, an operation should not be hastily undertaken; and another reason for delay is furnished by the fact that the pain and inconveniences resulting from varicocele often, indeed commonly, subside after a short time, the patient becoming accustomed to, and forgetful of, his complaint. I need hardly say that an attempt to obliterate the veins is better than castration, which the continued distress has induced some patients to request and some Surgeons to perform.‡

* The following description of the operation is given by Mr. Curling: "The vas deferens being separated from the mass of veins, and the latter being pinched up with a fold of the scrotum, a needle set in a handle with an eye near the point, armed with a double-looped thread, is to be passed beneath them. When the needle has traversed from one side to the other, the loop is to be drawn out, the needle retracted, and the veins let go, the skin alone being now held up. A second needle, similarly armed, is then to be passed through, over the veins, entering at the same hole by which the first needle was thrust out, and emerging at the same hole by which it entered. The second loop is next to be drawn out, and the needle withdrawn. The bundle of veins is thus included between two double threads, of which one passes over and the other beneath it. The ends of the thread on each side are then to be passed into the loop of the other, and now, by drawing these ends in opposite directions, the vessels are tied beneath the skin." "The vessels are divided, and the ligatures come away in from the tenth to the twentieth day."

† Delpech was assassinated by a man whom he had cured of double varicocele by tying the veins some years before. The man's testicles were found wasted and soft after death; the same effect upon the organ has been observed in other cases. The frequent reports of cases of operation for the cure of varicocele induce me to repeat the observation of Sir A. Cooper, that "varicocele should scarcely receive the title of a disease; for it produces, in the greater number of cases, no pain, no inconvenience, and no diminution of the virile powers." I cannot but think that operations are sometimes performed rather hastily and unnecessarily for this affection.

‡ M. A. Verneuil describes two cases of subcutaneous erectile venous tumours of the scrotum, dependent upon enlargement of the subcutaneous veins of the scrotum, and showing a tendency to spontaneous inflammation. They may be destroyed by cauterization or extirpation (*Gaz. Hebdom. de Méd. et Ch.*, Sept. 16, 1859, and Rankin's *Abstract* xxxi. p. 176). M. Escallier relates two cases of varicose tumour of

Tumours in the spermatic cord.

Fatty tumours are occasionally found in the cord, and, like the cysts in the same situation (p. 562), being movable to some extent in the course of the cord, they are with difficulty distinguished from hernia. I found this to be so in the case of a rather stout gentleman who, four years ago, had a swelling, about the size of a walnut, near the external ring. It was doughy, not tense or fluctuating like a cyst, but felt more like a hernia; and it passed a little way in and out of the canal. It could not, however, be returned into the abdomen; was influenced by traction upon the cord; and the finger and thumb could be approximated behind it in such a manner as to prove that it was not continued into the abdomen. I judged, therefore, and another Surgeon, who examined it with me, agreed, that it was a fatty tumour of the cord. Since that time not much change has taken place in it.*

Malignant tumours may form in the cord, not only as a sequence of disease of the testicle, but independently of it.†

THE AFFECTIONS OF THE VESICULÆ SEMINALES

have received very little attention from pathologists and Surgeons, less than they deserve; for these bodies are not uncommonly diseased in company with the testicles or independently of them; and such diseases may induce or aggravate inflammation of the bladder, and be productive of other ill effects. It is to be observed that the seminal vesicles lie within range of the finger passed into the rectum; so that their condition may, in most instances, be determined with tolerable certainty.‡

They seldom are the subject of spontaneous inflammation, but sometimes become inflamed secondarily, as in gonorrhœa; and the

the scrotum (apparently varicocele more circumscribed than usual), simulating hernia, in which spontaneous inflammation with suppuration took place and proved fatal. *Mém. de la Société de Chirurgie de Paris*, vol. ii. p. 66.

* In the Museum of the College of Surgeons (No. 2461) is an oval fatty tumour, four inches in length, imbedded in the tissues of the spermatic cord an inch above the testicle. In some instances the tumours have closely resembled omentum, and have even, it appears, been contained in a sac like a hernial sac. Curling, p. 453.

† Museum of College of Surgeons, 2462, 3. No. 2367²⁰ is described as a large fibro-plastic tumour of the cord.

In the Catalogue of the Museum of Mr. Heaviside is the entry of a "stone found in the cellular substance of the spermatic cord of a man who died of strangulated hernia." Gamgee, loc. cit. p. 181.

‡ It appears that a thesis has been written on inflammation of the seminal vesicles by M. Eugène Rapin in the *Moniteur des Sc. Méd.* 1859, No. 42. Canstatt's *Jahresbericht*, 1860, vol. iii. p. 284.

symptoms are much the same as when the prostate is inflamed, viz., uneasiness about the perineum, pain in defecation, frequent and rather painful micturition or retention, emissions at night, attended with pain and the fluid stained with blood. The finger in the rectum discovers the vesicle, on one or both sides, distinctly swollen and tender. In two cases of blennorrhagic orchitis, where the patients died of other disease, M. Goussail found the seminal vesicles swollen and gorged. I do not know of the affection terminating otherwise than in resolution; and I am not acquainted with any thing in these parts corresponding with the chronic orchitis, syphilitic or other, of the testicle. They are, however, not unfrequently the seat of scrofulous disease; and in cases of scrofulous affection of the testicles it is well to examine the state of the seminal vesicles; and they will sometimes be found considerably enlarged and firm, from deposit in their canals, although there may be no symptoms of such a condition. The changes that take place correspond precisely with those that occur in the epididymis; that is to say, the tortuous component tubes become enlarged and distended with scrofulous matter, partly infiltrated into the lining membrane, and partly formed of morbid and accumulated epithelium, while the connecting areolar tissue of the tubes remains sound. Subsequently this may be destroyed, if softening and suppuration take place. I have dissected several specimens of this; and some of them are in the pathological Museum of the University of Cambridge.

The disease is only to be distinguished by examination with the finger in the rectum; and for want of this exploration it escapes notice in many cases. The organ will be found enlarged, perhaps tender and more or less firm according to the condition of the morbid deposit in it. The prostate is likely to be the seat of tuberculous disease at the same time. It has been so in the cases that I have dissected. The treatment corresponds with that for scrofulous disease in the testicle and other parts.

I have in several cases known a chronic enlargement of the vesiculæ seminales analogous to the affection of the prostate in elderly persons, and attended with corresponding symptoms of irritation of the bladder. Indeed, I have discovered it when examining the rectum under the impression that there was enlargement of the prostate. What relation, if any, this condition of the vesicles may have had to the bladder-symptoms, I cannot tell. I first found it in dissecting the bladder of an old man who died after long-continued prostatic affection with retention. The prostate was enlarged, and the seminal vesicles were two or three times

as large as natural, of very firm structure, so as, in consistence, almost to resemble scirrhus; the component canals were large, and the investing areolar tissue much hypertrophied and indurated. I have now a man above seventy under my care, suffering under severe irritation of the bladder amounting to incontinence, in whom the prostate is little, if at all, enlarged; but the seminal vesicles may be felt beyond it of twice their natural size and firmer than usual. In other instances I have found on the dissection of the vesiculæ seminales in elderly persons, that the component tubes were dilated, but actually reduced in extent and length, while the connecting and investing areolar tissue was thickened.

Although in the case of imperfect development of the testes at page 546 the seminal vesicles were very small, consisting of few coils of tubes, usually the condition of these bodies shows no especial relation to that of the testes. One testicle may be wanting or imperfectly developed, or the vas deferens may be only partially formed, or have been divided, or become obliterated; yet the vesicula seminalis on that side is commonly as large as on the other side. It is in such case filled with its own secretion unmixed with spermatozoa. This corresponds with what has been said (page 541) respecting the presence of the ejaculatory power in persons whose testes were imperfect or absent.

AFFECTIONS OF THE SCROTUM.

Œdema. The loose tissue of the scrotum renders it very liable to oedema, which is often met with in new-born and young children, resulting in them, commonly, from some slight irritation of the skin, and usually subsiding under careful attention to keep the part dry and powdered.* In after life it is easily induced by inflammation or suppuration of adjacent parts, especially abscess connected with the urethra; and sometimes it is the herald of, or attendant upon, general dropsy, resulting from disease of internal organs. It is usually dependent upon some such cause, general or local, and subsides when that cause is removed. Great relief, however, may sometimes be afforded, and sloughing of the part prevented, by punctures with a needle at various points, which allow the serum to drain off, and are rarely followed by any of the ill effects which are likely to ensue if incisions be made.

* It is, however, sometimes more troublesome and dangerous. I was called to a case of the kind, in which the inflammation and swelling was very great, like erysipelas, and extended to the penis and adjacent parts, causing retention of urine, and proving fatal in a few days. Two similar cases, also fatal, are given in *Med. Times and Gaz.* vol. xii. p. 364.

Inflammation. Its loose structure and its comparatively isolated pendulous position also render the scrotum an easy prey to inflammation, erysipelatous or other, which is apt to be excited by slight causes, such as small wounds or abrasions, boils or small abscesses in or near it. The inflammation quickly spreads, causing rapid œdema; and, if the patient be in a low state of health, it may go on to diffuse suppuration and sloughing of the skin and subcutaneous tissues. Mr. Liston* described cases of "rapid distension of the scrotum with serosity" supervening generally upon an abscess or ulcer, perhaps trifling, in the perineum or groin; and he found that destruction of the cellular tissue and skin could be arrested only by very early and free incisions. Sometimes inflammation is excited by the dribbling of urine; or it may arise without any apparent cause. An abscess rarely forms in the scrotum. When suppuration takes place, it is usually diffuse, and may be recognised by the hard feel and angry appearance of the part, added to the dry tongue and low feverish state of the patient. This result, as well as sloughing, may commonly be averted, where the constitution is sound, by rest in the recumbent position, warm fomentations, and such diet as the condition of the patient requires. If suppuration takes place, or if the discoloration of the skin threatens gangrene, incisions should be made; and it may be necessary to give wine and ammonia to maintain the strength. Under careful treatment the affection, even in severe cases, rarely terminates fatally. After large portions of the scrotum have been destroyed, and the testicles and spermatic cords have been laid bare, granulation and cicatrisation proceed with surprising rapidity, and, owing to the abundance of loose skin, the breach is healed without much detriment.

Though so liable to slough from inflammation excited by a local cause in enfeebled persons, the scrotum is very seldom the seat of mortification from frost-bite. Cases of the kind have, however, been witnessed by Sir A. Cooper and Mr. Curling.

Elephantiasis of the scrotum, so rare in this country,† is very

* *Medico-Chirurgical Trans.* vol. xxii. p. 288. Mr. Erichsen (*Med. Times and Gaz.* vol. xxi. p. 211) gives a case of acute inflammatory œdema of the scrotum, supervening on a perineal swelling, which first appeared during gonorrhœa, and ending in gangrene. The whole scrotum sloughed, laying bare the testicles.

† One of the best-marked cases of the tuberculated form of the disease that has occurred in this country is related by Mr. Isaacson in vol. xviii. of *Prov. Med. and Surg. Trans.* p. 244. In the Museum of King's College Hospital is a specimen of elephantiasis of the scrotum removed by Mr. Fergusson from a man who had never been out of this country. The mass weighed 5 lb. 15 oz.: the disease was the result of inflammation consequent on a blow. Cases have also been recorded by Liston, *Operative Surgery*; Brett, *Lancet*, July 11, 1846. Cases occurring in other parts of Europe have been related by Delpech, Lamy, Delmas, Auvert, and Nögell. In the Museum of the College of Surgeons, No. 2466, is an enormous mass of

common in tropical climates, especially Bengal, the East and West Indies, Ceylon, Egypt, and South America. It consists in a thickening with some change of structure—a modified hypertrophy—of the skin and other tissues of the scrotum, which are, in addition, infiltrated with serum or oily matter, the latter being sometimes so abundant as to give to the whole the characters of an oleaginous mass. The cremaster has been found thickened, and the spermatic cords elongated; but the testicles are usually healthy. Sometimes there is hydrocele. The disease, which is probably essentially of a low inflammatory nature, commences, in some cases, at one point, and thence spreads gradually over the scrotum; or there may be a tumefaction of the whole bag, which subsides in part, and then returns, and finally becomes permanent and increases. It may be excited by some local cause, such as a fistulous tract; but more commonly there is nothing of the kind. In some cases the part remains smooth; in others it becomes uneven, tuberculated, and corrugated; but in either case it has little or no tendency to ulcerate, unless it be in consequence of abrasion when it has acquired great bulk. It simply goes on increasing, without pain, remaining dry on the surface; and the increase is of a very determined character, no local or general treatment seeming to have much influence on its progress. The mass, in course of time, attains to enormous size, weighing fifty, a hundred, or even a hundred and fifty pounds, and proves fatal by its distressing weight, or perhaps by ulceration and discharge supervening. Several of the patients have been observed to have ichthyosis in other parts of the body.

Treatment. In the early stage, especially if the disease assume at all an acute form, it may probably be arrested by measures calculated to allay chronic inflammation of the skin, of which the most important would be pressure. It is, however, by no means certain that such treatment would be effectual; and much time should not be lost in the attempt, otherwise the mass will attain to such dimensions as to render the radical treatment dangerous. Unfortunately, the case is commonly not seen by the Surgeon till the period has passed at which curative means are at all likely to be efficient, and removal offers the only prospect of success. This has been done by Mr. Esdaile in 161 cases, with the loss of only five per cent. When the tumour is of moderate size, therefore, its removal is a matter of little danger; and the testicles and penis may be dissected out and saved. When the mass has attained to great size,—more than forty pounds,—the hæmorrhage consequent on the division of the vessels feeding so large a mass is frightful; and

scrotal elephantiasis, measuring 42 inches in circumference, including the penis and testicles, consisting chiefly of compact structure like mammary gland, and covered with coarse skin, in parts warty and knotty. It was removed by Mr. Liston from a man æt. 22, who recovered.

it is necessary to cut the tumour away as rapidly as possible, without regard to the genital organs; and with all care the patients have in some instances sunk at the time or soon afterwards from loss of blood.*

Tumours of the scrotum are rare. Of *cystic* tumours I have met with only two recorded cases.† *Fatty* tumours seem to be rather less uncommon.‡ Both have proved very difficult of diagnosis. Of *fibrous* tumours several instances have been collected by Mr. Curling; and others have been related. They originate in the areolar tissue, and grow slowly and without pain. Some are very dense, resembling the fibrous tumour of the uterus, and, like it, undergoing occasionally calcification at various parts of the mass; others are more succulent. They may attain to enormous size, weighing twenty, thirty, or more pounds; and have been removed successfully when of this magnitude. Some of the cases have been of the recurrent kind of fibrous or fibroid.§

We read now and then of large calculi which have formed in the bladder finding their way into the scrotum, and escaping from it by ulceration|| or being excised.

* See a case by Mr. H. Walton, *Med. Times and Gaz.* vol. xix. p. 132, in which he tied the scrotum in small segments close to the trunk, removed the mass below the ligatures; and then, as each strangulated part was liberated, the vessels were secured. The scrotum was eight or nine pounds in weight. The patient recovered.

M. Clot-Bey has given his extensive experience respecting this malady in his *Histoire d'une Tumeur éléphantiaque du Scrotum*, Marseille, 1830; in the *Annales de la Médecine physiologique*, 1834; and in the *Mém. de la Société de Chirurgie de Paris*, vol. iv. p. 547. He regards it as a local affection, distinct from lepra; the principal phenomena being tumefaction, hypertrophy, and inflammation of the skin and subcutaneous tissue; the tuberculous condition of the skin being only an occasional attendant. He believes it incurable, except in quite early stages; and the patient will then rarely submit to the requisite treatment. Extirpation of the part should therefore be practised without delay.

† A transparent cyst, of the size of an apple, containing unctuous yellowish fluid, situated in the cellular tissue of the scrotum, connected with the skin, and supposed to have originated in the sebaceous follicles of the skin, is described by Dr. Bauchet; *Archives Gén. de Méd.* 5^e série, vol. ii. p. 71. Mr. Curling describes and represents a cystic mass, like cystic sarcoma of the breast, removed from the scrotum by Mr. Crompton of Manchester.

‡ *Trans. of Path. Society*, vol. vi. pp. 230 and 232; Curling *on the Testicle*, p. 490; Kimball, in *Boston Med. and Surg. Journal*, Oct. 17, 1861.

§ This was so in a case operated on by Mr. Fergusson: a large fibrous tumour was excised from the scrotum; and three years afterwards it recurred, and was of the size of a child's head, involving also the nates. The whole mass was removed. *Med. Times and Gaz.* vol. xiv. p. 166.

|| Auvert (*Selecta Praxis Medico-Chirurgica*, vol. ii. tab. cxi.) represents and describes an enormous urinary calculus, which began to form when the patient was 10 years old, and ulcerated through the scrotum when he was 71. A urinary calculus, weighing 8 ounces, in the Norwich collection, is said to have been removed from the scrotum. A shoemaker had, for 20 years, a stone in the scrotum, which he supported in a pad; at length it got to such a bulk, that, during exertion at stool, it ruptured the scrotum and escaped: it weighed 26 oz. Gräfe "Ueber Scrotalsteine," in *Gräfe and Walther's Journal*, vol. iii. p. 399. Crosse *on Urinary Calculus*, p. 32.

Cancer of the scrotum is almost always of the epithelial kind,* and usually confined to chimney-sweeps.† It is much more common in this country than in others; but it appears to be on the decrease here; perhaps owing to the more general use of machines. In its origin, structure, course, and implication of adjacent glands, without involving more distant regions, it corresponds with epithelial cancer of the skin in other parts. Thus, it commonly begins in a small soft tubercle or wart on the scrotum, oftenest near the lower and fore part. This tubercle appears to be of simple nature, and may remain for a long time without change, only increasing very slowly. Sooner or later it becomes indurated, spreads, and is covered with a crust;‡ and when the crust is removed it bleeds a little. Subsequently it ulcerates, and an uneven open surface is formed, discharging thin bloody fluid, and having a sinuous edge with a hard tuberculated margin and an indurated base. The disease goes on spreading till the whole scrotum is destroyed; and the testicles are exposed and, occasionally, it is said, are involved in the destruction. Before this, however, the inguinal glands usually become indurated. Subsequently they soften and break, forming excavated cancerous ulcers, which spread till the patient is worn out by the discharge and pain. After death the disease is commonly found to be confined to the scrotum and groin, and not to have invaded the lumbar glands or the abdominal viscera.

It seems, then, to be quite a local affection, destroying life by the mere tendency to spread at the part primarily affected, and in the glands connected with it; and at first, and, it may be, for a long time, it often has hardly any of the qualities of malignancy. In one case that I remember, the surface of the body generally, and of the inner side of the thighs in particular, was covered with small soft cutaneous tubercles, evidently quite of simple character; and the cancerous ulceration of the scrotum had, apparently, originated in one of these. Moreover the ulcerative tendency at the part varies a good deal. In some cases it commences before the mass has

* A rare case of the growth of medullary cancer in the cellular tissue of the scrotum, involving and requiring the removal of both testes, occurred in the practice of Mr. Craven of Hull. *Med. Times and Gaz.* vol. xix. p. 287. Mr. Curling mentions two cases of carcinoma of the scrotum, and one of melanosis.

† Dr. Warren has never seen it in the United States in chimney-sweepers, but has met with it in a few instances in persons not of that business. *Surg. Obs. on Tumours*, p. 329. In a few cases, in this country, it could not be attributed to the contact of soot. That it may be excited in other parts of the body by soot, is shown by Sir James Earle's case of the gardener who suffered from the disease in the forearm in consequence of his being in the habit of carrying a soot-bag there.

‡ Or by a thick horn-like concretion, as represented by Mr. Ward: *Cases of dis. of the Prepuce and Scrotum*, pl. x. and xi.

attained to the size of a shilling; in others the whole scrotum becomes converted into a tuberculated or warty mass, with scarcely any ulceration. I had one case of the latter kind in which the disease was of long standing, and too extensive for removal, and which terminated fatally. It has been met with in boyhood, but is usually seen about middle life, and has appeared in persons long after they had discontinued the avocation of chimney-sweeping.

Treatment. The only treatment is extirpation by caustic or the knife; the latter is much to be preferred. The operation is easily performed while the disease is limited to a part of the scrotum, and good hope of ultimate recovery attends it. Still in several cases the disease has returned, sometimes after a long interval, either in the scrotum or the groin. In such case the operation should be again performed; indeed, it may be repeated again and again, even though it be necessary to take away the whole scrotum and both the testicles, if there be fair prospect of removing all the disease. When the glands in the groin are only slightly enlarged they should be left alone; for they may subside or remain quiescent after the exciting cause of their disturbance is gone. If, however, the enlargement is more decided and accompanied with induration, they should be dissected out; and this may be done with very good result; for the disease of the glands is found to be of epithelial character, corresponding with that in the scrotum. In one case, in which I dissected out the diseased inguinal glands at the same time that I removed the cancerous ulcer of the scrotum, the patient was well two years afterwards; in another the disease soon returned and proved fatal. This corresponds with the experience of other Surgeons.

AFFECTIONS OF THE PENIS.

By far the larger proportion of these are, directly or indirectly, connected with and dependent upon gonorrhœa and syphilis; and they, as well as phimosis, paraphimosis, and inflammation of the corpora cavernosa, will be found treated of in the following essay.

Gangrene. The loose tissue of the organ renders it, like the scrotum, very liable to œdema and inflammation; and its comparative isolation renders it liable also to mortification, which has in several instances been known to occur in the depressed states of typhus. In some of these cases the patient was suffering from gonorrhœa at the commencement of the attack. The penis has also been known to mortify in paraplegia; and a case of spontaneous gangrene occurred, under the care of Mr. Partridge, in King's College Hospital.*

* "The man was forty years old, single, and said to be temperate. A week before his admission he was at work as usual, when he became ill, languid and feeble. He took to his bed and ultimately became delirious. He was kept on low diet all this time. When received into King's College Hospital he looked like a man suffering from low fever. The penis was black and charred-looking nearly down to the scrotum; there was here a line of demarcation, and the urine spirted

Cancer of the penis is, I believe, invariably of the epithelial variety, and corresponds in most points with epithelial cancer in other parts of the body.

It commences usually upon the glans, in the form of a firm warty elevation having a broad base, and slowly increases, for some time, without pain and, probably, without attracting attention. It is at first covered with a more or less thick cuticular crust. This becoming shed, or rubbed off at parts, the growth bleeds a little, and, before long, ulcerates, discharging thin foetid fluid mingled with blood. In this stage it is usually painful, and advice is, therefore, sought for it. If left alone it continues to spread, destroying the glans, opening the urethra, involving the prepuce, and, finally, extending to the glands of the groin, proves fatal by the irritation and discharges resulting from progressively spreading ulceration. It does not affect distant organs. It now and then begins upon the prepuce. Sometimes the prepuce is in a state of phimosis, perhaps from birth; or it may be ulcerated through, disclosing the growth beneath. Frequently, however, the prepuce is natural, and may be drawn backwards and forwards over the cancer.

There is not commonly much difficulty in the diagnosis, partly because the cases do not come under our notice till the character of the disease is well marked. The patient has generally passed the middle period of life. The firmness, or hardness, of the growth, its ulcerating tendency, and the character of the discharge, together with the slow steady progress, leave little doubt of its nature. In the early stages it is not so easy to make the distinction between a cancerous wart and a common wart, or between a cancerous lump and an indurated chancre which has not ulcerated, or has cicatrized. It is, then, well to give a cautious opinion, and to wait a short time, applying the means which are known to act upon the more simple malady; and it will generally turn out that those means are

out at this point. The pulse was feeble and irregular. The penis ultimately dropped off. The parts healed, and the patient went out well." *Med. Times and Gaz.* vol. xx. p. 277.

The following case of partial strangulation of the penis from constriction is interesting in many respects. A boy was brought to the out-patient room of St. Bartholomew's Hospital with swelling of the penis and loss of sensation, and a fistulous passage communicating with the urethra. Mr. Wormald discrediting the cause assigned (a blow) made a careful examination of the parts under chloroform, and discovered a small string tied round the base of the penis. It appeared that as the penis had swelled, the ligature had slowly cut through the skin, nerves, and vessels of the penis; but, as in the operation of linear *écrasement*, the parts healed again as fast as they were cut, and had buried the ligature. *Association Med. Journ.* 1856, p. 971.

sufficient,—that is to say, the doubtful cases generally prove not to be cancerous.

The only *treatment* is extirpation ; and that is best effected with the knife. If the prepuce only be affected, circumcision should be performed.

Circumcision. The plan which I always adopt is to make a circular incision with a bistoury through the skin on a level with, or a little behind, the corona glandis ; then slit up the prepuce to this cut, and with scissors remove it by cutting through the lining membrane a little in front of the incision through the skin. The frænum should be left as long as it conveniently can be. The dorsal arteries, and one or two arteries beneath the urethral orifice, generally require ligature ; and care should be taken to sponge the wound well, and tie such others as bleed at all freely, so as to prevent after trouble. The edges of the skin and the lining membrane may then be brought together with a few points of suture, so that only a linear wound remains. This will sometimes heal in a few days, leaving only a linear scar. It is often not necessary to confine the patient to bed at all, though it is better to do so, or, at any rate, to enjoin rest. I do not apply any lint, plaster, or dressing. These adhere to the part, causing a good deal of distress, and keeping it foul. I simply direct it to be kept dry and clean. It may, after a few days, when suppuration takes place, be necessary to apply a poultice, or water-dressing. I once saw the operation performed with the *écraseur*. There was no bleeding ; but an ulcerating wound remained, which was long in healing.*

Amputation. When, as is far more commonly the case, the disease commences on the glans, it may still be possible to remove the affected part without destroying the whole of the glans, or interfering with the urethra. I have done this with good result. It seldom happens, however, that we see the case sufficiently early for this ; and it is usually necessary to remove the whole of the glans and more or less of the corpora cavernosa. Before doing this, the prepuce, unless it admits of being retracted, should invariably be laid open, so as to expose the growth, and make quite sure of its real nature. The operation of amputation is effected by a single sweep of the knife, the skin having been previously drawn a little forward, to prevent there being a superabundance of it afterwards. A good deal of bleeding ensues, the blood pouring out from the whole divided surface of the corpora cavernosa, as well as from the dorsal arteries. The latter should be tied first ; then the larger vessels upon the rest of the stump ; and the numerous smaller vessels will close spontaneously after a few minutes. The dread of the bleeding has induced the occasional resort to the *écraseur*. That, however, is not a sure preventive ; for sharp hæmorrhage has followed a few hours after the operation ; and it leaves a more sloughy and troublesome wound than the knife.

The stump will granulate and heal spontaneously, the skin closing over the face of it, and becoming puckered to a narrow circle surrounding the urethra orifice. The real, indeed usually the only, difficulty in the operation and subsequent management is caused by the tendency of this circle to contract, more and more, so as to narrow the orifice and interfere with the passage of urine. In a case that I remember, the stricture thus caused led to so much irritation and inflammation of the bladder that the patient, a strong hearty man at the time of the operation, was fairly worn out and died. It is true that in other cases this difficulty has not occurred, although no means have been taken to prevent it. Nevertheless, the liability must always be

* I quite agree with those who recommend the entire removal of the prepuce in congenital phimosis, having seen the inconveniences resulting from less complete operations. The comparative immunity from syphilis in those who have been circumcised has been shown by Mr. Hutchinson. *Med. Times and Gaz.* Dec. 1, 1855.

borne in mind. It may be sufficient to keep a catheter, or other instrument, in the passage. Some patients cannot bear that; and it is well to avoid its necessity by adopting the following slight addition to the operation recommended by Mr. Teale.* "After the operation of amputation has been performed in the ordinary way, a director is introduced into the urethra, and, by the aid of a bistoury, the urethra and the skin covering it are slit up to the extent of about two-thirds of an inch. A single suture is then placed on each side of the slit, uniting the mucous membrane to the skin. Perfect patency is thus given to the orifice, which is of a long, oval form; and, after cicatrisation is complete, there remains a free opening into the urinary canal, and no mechanical aid is required. The same procedure may be adopted when contraction has occurred during the cicatrisation after amputation, and much trouble and pain will thus be spared."

When the disease has been completely removed, there is fair prospect of complete cure. I have watched patients remaining for several years in good health. Too many cases, however, have proved the tendency of the disease to manifest itself in the groin after the removal in the penis, if it had not done so before. The affected glands should be removed, if that can be done with safety; the remarks made with regard to the conditions ensuing upon cancer of the scrotum applying to this disease.

GEORGE MURRAY HUMPHRY

* *Medical Times and Gazette*, vol. xix. p. 354.

GONORRHŒA.

OF the diseases of the generative organs which, for the most part, take their origin from impure sexual congress, pathology and clinical observation have alike established the existence of three groups, separate and distinct from one another.

I. Gonorrhœa—an inflammation of the mucous membrane of some part of the generative organs, producing muco-purulent discharges. In the male this is frequently attended with an inflammation of the testicle, and in some cases is followed by symptoms referable to the joints and eye.

II. The soft, suppurating, contagious ulcer of the genitals, which differs from the next in the most important characteristic, that it is localised in its sphere of morbid influence, and does not induce general or constitutional infection.

III. That disease which, commencing as a localised affection of some kind, generates those other and more general morbid symptoms denominated constitutional syphilis.

These all agree in the respect that they are contagious, and, however much opinions may differ as to the former, the two last have for their cause a specific virus.

The most frequent disease arising from sexual intercourse is, without doubt, gonorrhœa. This name, although somewhat incongruous—for the prominent symptom of the disease is not a flow of semen, as the derivation of the term indicates, but a muco-purulent or purulent secretion and discharge from the diseased surface—has been so long in use that its abolition would be attended with difficulty.

By some writers the affection is termed “blennorrhagia.” By the vulgar it is termed the “clap” in England, and “chaude-pisse” in France.

There is every reason for believing that this disease has been known from very remote times. The sanitary measures inculcated by the Hebrew lawgiver in the 15th chapter of Leviticus have, in all probability, reference to this disease. It appears likewise to have prevailed among the Greeks and Romans.

Very shortly after the irruption of syphilis into Europe, towards the close of the fifteenth century, a belief in the unity of species and cause of all the contagious diseases of the genitals became widely prevalent. Observers, perceiving that these diseases commonly originated from one source—sexual congress—referred them all to one and the same cause, embracing them alike in the common term of ‘venereal.’ The confusion and perplexity thus introduced continued to our own day. To the genius and sagacity of Ricord it is undoubtedly due that these almost insuperable difficulties to the right appreciation and study of these diseases have been removed.

Gonorrhœa is an affection of a totally different character to the primary syphilitic ulcer—whether we have regard to its history, pathology, symptoms, terminations and consequences, or its treatment.

Acknowledging all this, as is generally done in these days, there remain a number of well-observed facts which would seem, nevertheless, to militate against it. The writer alludes to those cases in which symptoms of secondary syphilis follow discharges from the urethra, apparently identical with those produced by gonorrhœal inflammation. The explanation usually given is, that when urethral discharges have preceded a syphilitic infection, such discharge has been symptomatic of a chancre within the urethra—chancre larvé—of Ricord. In support of this theory it is alleged—1st, that intra-urethral chancres have been demonstrated in some such cases, and hence probably existed in the remainder; 2dly, that the inoculation of urethral discharge has been followed occasionally by the same phenomena as succeed the inoculation of fluids from a chancre; 3dly, that acquired constitutional syphilis, whenever its course has been observed, has invariably been preceded by some primary lesion of the nature of chancre, and hence that it is in the highest degree probable that the same process ensued within the urethra, where it is concealed from our sight, as obtains in other parts patent to our observation.* It is important to remember that those who deem the foregoing theory unsatisfactory, when applied to *all* cases in which constitutional symptoms have succeeded urethral discharge clinically identical with gonorrhœa, do not at all deny the existence of urethral chancre. They contend that all we can say in these exceptional cases amounts to this—that the existence of chancre has been presumed but not demonstrated; and that from time to time cases of secondary syphilis ensue after discharges from the urethra, in which it has been quite impossible to distinguish the urethral disease from gonorrhœa, and wherein all the evidence at command was strongly against the existence of a chancre concealed within the urethra. Many deny altogether the existence of a chancre deeply seated in the urethra. Vidal, for example, does not admit such, beyond the navicular fossa. The transmission of a virus to a distant part of a canal like the urethra is confessedly difficult of explanation, and it has not been demonstrated to the satisfaction of many pathologists that the two morbid specimens of deep-seated ulceration of the urethra, upon which M. Ricord relies to establish his theory of the chancre larvé, were in reality chancres at all.

The importance of the subject renders it essential that we should endeavour to obtain clear views upon it.

From the time of Swediaur to the present day there has been a well-grounded belief in the existence of a syphilitic blennorrhagia. Hunter, who believed in the identity of gonorrhœa and syphilis, cites the results of his inoculation of pus from a gonorrhœa, which inoculation produced sores having all the characters of chancres, and were followed by symptoms of general infection. The high reputation which Hunter has acquired and maintained as the model of an observer—at once patient, sagacious, and profound—entitles every thing of his to the greatest consideration and respect.

We give the quotation entire from the edition of his works in 1786. The experiment was commenced in May 1767. Upon the authority of Babington it was known to have been performed on Hunter himself, who may be thus said to have dedicated body and mind to the investigation of disease.

“Two punctures were made on the penis with a lancet dipped in venereal matter from a gonorrhœa; one puncture was on the glans, the other on the prepuce. This was on a Friday; on Sunday following there was a teasing itching in those parts, which lasted till the Tuesday following. In the mean time these parts being often examined, there seemed to be a greater redness and moisture than usual, which was imputed to the parts being rubbed. Upon the Tuesday morning the parts of the prepuce where the puncture had been made were redder, thickened, and had formed a speck; by the Tuesday fol-

* Vidal, *Traité des Maladies Vénériennes*, p. 169.

lowing the speck had increased and discharged some matter, and there seemed to be a little pouting of the lips of the urethra, also a sensation in it in making water, so that a discharge was expected from it; the speck was now touched with lunar caustic, and afterwards dressed with calomel ointment. On Saturday morning the slough came off, and it was again touched, and another slough came off on the Monday following. The preceding night the glans had itched a good deal, and on Tuesday a white speck was observed where the puncture had been made; this speck when examined was found to be a pimple full of yellowish matter. This was now touched with the caustic, and dressed as the former. On the Wednesday the sore on the prepuce was yellow, and therefore was again touched with caustic. On the Friday both sloughs came off, and the sore on the prepuce looked red, and its basis not so hard; but on the Saturday it did not look quite so well, and was touched again; and when that went off, it was allowed to heal up, as also the other, which left a dent in the glans. This dent on the glans filled up in some months, but for a considerable time it had a bluish cast.

"Four months afterwards the chancre on the prepuce broke out again, and very stimulating applications were tried; but these seemed not to agree with it, and by letting it alone it healed up. This it did several times afterwards, but always healed up of itself. That on the glans never did break out, and herein also it differed from the other.

"While the sores remained on the prepuce and glans, a swelling took place in one of the glands of the right groin. I had for some time conceived an idea that the most effectual way to put back a bubo was to rub in mercury on that leg and thigh, which would send a current of mercury through the inflamed gland; this afforded a good opportunity of making the experiment. I had often succeeded in this way, but now wanted to put it more critically to the test. The sores upon the penis were healed before the reduction of the bubo was attempted. A few days after beginning the mercury in this method the gland subsided considerably, it was then left off; for the intention was not to cure it completely at present. The gland some time after began to swell again, and as much mercury was rubbed in as appeared to be sufficient for the entire reduction of the gland; but it was meant to do no more than to cure the gland locally, without giving enough to prevent the constitution from being contaminated.

"About two months after the last attack of the bubo, a little sharp pricking pain was felt in one of the tonsils in swallowing any thing; and on inspection a small ulcer was found, which was allowed to go on till the nature of it was ascertained, and then recourse was had to mercury. The mercury was thrown in by the same leg and thigh as before, to secure the gland more effectually, although that was not now probably necessary.

"As soon as the ulcer was skinned over, the mercury was left off, it not being intended to destroy the poison, but to observe what parts it would next affect. About three months after, copper-coloured blotches broke out on the skin, and the former ulcer returned in the tonsil. Mercury was now applied the second time for those effects of the poison from the constitution, but still only with a view to palliate.

"It was left off a second time, and the attention was given to mark where it would break out next; but it returned again in the same parts. It not appearing that any further knowledge was to be procured by only palliating the disease a fourth time in the tonsil and a third time in the skin, mercury was now taken in a sufficient quantity, and for a proper time, to complete the cure.

"The time the experiments took up, from the first insertion to the complete cure, was about three years."

These facts can neither be mistaken nor ignored. Their explanation is well worthy of a digression upon our part. Two views will be assumed, either of which will yield a probable explanation: first, that the urethral pus was obtained from a concealed syphilitic sore (chancre larvé), alone and unmixed, or mingled with the products of a coexisting gonorrhœa. The second view

rests upon the assumption, that not only the fluid products of secondary lesions, but that the blood and fluid excretions from a person constitutionally syphilitic, may produce that disease in a sound person by inoculation.*

It ought not to be forgotten also that the mucous membranes are the frequent seats of the earliest constitutional manifestations, and that a mucopurulent discharge from the urethral membrane is an occasional symptom of secondary syphilitic infection.†

Hunter conceived that the pus from a chancre or blennorrhagia applied to a secreting surface (mucous membrane), would invariably produce gonorrhœa; while applied to a non-secreting one, such as the integument, it would equally always develop a chancre.

It is true that this pathology cannot hold its place in the presence of later observations and experience: but there are not wanting a few, though extremely rare, facts corroborative of the truth of Hunter's view of a "physiological absorption," i.e. the absorption of virus into the blood, without any lesion of the surface to which it is applied.

The bubon d'emblée is an example of this. When we speak of a primary infecting sore, we must remember that these do not alike possess the same objective signs. A primary syphilitic lesion may possess scarcely any induration; and the same may be said of its ulceration or erosion, the amount of which may be barely appreciable. We are ignorant how far the physiological properties of the deeper tissues of the urethra may affect the development in them of specific disease, because of our inability to watch the progress of the disease in the parts.

It has been proved that a purulent fluid, furnished by the female generative organs, can excite a gonorrhœa. Now if such fluid be obtained from a woman constitutionally syphilitic—and uterine discharges are very frequently indeed present in such—there is no reason against its being the vehicle of a syphilitic virus. The primary syphilitic disease will then run its course in the urethra as a part and parcel of the gonorrhœal inflammation, and the limits of any induration which usually accompanies primary syphilitic disease will be lost in the swollen state of the tissues.

The bearing of the following upon the foregoing remarks will be obvious. It is extracted from Dr. Marston's Report upon Syphilis, in the *Medico-Chirurgical Transactions*, vol. xlv. p. 425.

"Two men were admitted into hospital with gonorrhœa, Br. A— and Gr. S—. At the time of this occurrence we had the power to report any case of venereal, and upon the woman being pointed out by the affected individual to the police she was handed over for inspection and treatment. The men came to hospital within forty-eight hours of each other, and were placed in contiguous beds. Gr. S— went with the police, and pointed out the source of his contagion. Br. A— went on the same errand to the same house, and found the woman already removed. Gr. S— told me that, to their mutual surprise, they discovered that it was the same woman in each case. Both suffered from all the symptoms of gonorrhœa, and there was no suspicion to the contrary. Br. A— had suffered from syphilis before, Gr. S— never. After remaining in hospital a long time, Br. A— was discharged cured, and no further symptoms, so far as I could trace, appeared in his case. Gr. S—'s recovery

* See the writer's work on *Syphilitic Inoculation*, 1863; also Viennois in *Archives Gén. de Méd.* June 1860.

† Vide Bassereau, *Affections Syphilitiques de la Peau*, p. 356.

Rollet seems to have arrived at the conclusion, that although the blood of syphilitised persons is inoculable, their pus is not. He says, that if pus be taken from the urethra of a syphilitic person suffering from gonorrhœa, but whose genital organs are free from syphilitic eruption, and if this pus be inserted in the mucous membrane of another, free from any syphilitic taint,—an ordinary gonorrhœa only succeeds: if blood, however, be taken and mixed with the pus, then both gonorrhœa and syphilis may follow.

was delayed from gleet and irritable bladder, for which instruments (Nos. 10 and 12) passed without difficulty or local tenderness, and no hæmorrhage. After appearing anæmic and in ill-health, Gr. S— had sore throat (ulcerated tonsils) and a guttural voice; subsequently papules appeared upon the inside of the lips, coincident with psoriasis palmaris and nocturnal rheumatism. The inguinal glands were slightly enlarged symmetrically. For these symptoms he took iodides of mercury and potass, with mercurial vapour-bath, by which means, after many relapses, he was cured. I passed sounds, and tried to discover a localised induration, without avail. Some urethral discharge was inoculated upon the skin of the thigh without any effect.

"The woman in this case, I learnt from the civil surgeon, had a vaginal discharge, but no primary ulcer that he could find. She was, however, suffering from acne of the face and a cutaneous syphilide."

Discharges from the urethra and mucous passages of the generative organs may arise from the application of various purulent and irritating secretions to the mucous membrane, or be symptomatic of some constitutional or other disease.

The causes of blennorrhagia will fall under one or other of the following heads:

1. The application of a gonorrhœal discharge to a part of the sexual organs—direct contagion.

2. Certain irritating substances applied to the mucous membranes, *e. g.* menstrual fluid, leucorrhœal discharges, &c. and other irritants, rather interesting to the pathologist than of any practical value to the Surgeon—such as the injection of a solution of ammonia, as in the experiment of Swediaur upon himself.

3. Urethral discharge may arise from constitutional and other causes, irrespective of any contagious influence; as in scrofulous, gouty, or rheumatic subjects, and after the use of certain drugs, &c.

Complaints closely resembling gonorrhœa sometimes appear in persons the subjects of stricture or irritable urethra, after sexual intercourse, a debauch, or other excitement.

Occasionally, though very rarely indeed, venereal excitement alone may induce a blennorrhagia of the urethra.

As every one is perfectly well aware, gonorrhœa is very frequently the result of direct contagion, from intercourse with a person similarly affected. It is needless, therefore, to enlarge upon this; but it is of the utmost importance, in a medico-legal sense, to remember that the symptoms of gonorrhœa may be produced by various agents other than the application of gonorrhœal pus.

It is absolutely certain that gonorrhœa in the male may proceed from intercourse with a woman in whom no morbid changes in the genital organs can be detected upon minute examination with the speculum. Ricord's remarks upon this subject deserve attention. He says:

"If we investigate with the greatest care the exciting causes of gonorrhœa—and I am now speaking of the most characteristic cases of the disease—we cannot help admitting that a gonorrhœal virus is absent in the majority of cases. Nothing is more common than to find women who have occasioned gonorrhœa unsurpassed in intensity and persistency, and attended by the most serious complications, and who are yet only affected with uterine catarrh, which is sometimes hardly purulent. In many cases, intercourse during the menstrual period appears to be the only cause of the disease; while, in a large number, we can discover nothing, unless, perhaps, errors in diet, fatigue, excessive sexual congress, the use of certain drinks, as beer, or of certain articles of food, as asparagus. Hence the frequent belief of patients, which is very often correct, that they have contracted their gonorrhœa from a perfectly sound woman.

"I am most assuredly familiar with all the sources of error in such investigations, and I will presume to say that no one is more guarded than I am against the various forms of deceit which are strewn in the path of the observer; yet I confidently maintain the following proposition: *Gonorrhœa often arises from intercourse with women who themselves have not the disease.* Any one who studies gonorrhœa without preconceived notions, is forced to admit that it often originates from the same causes that give rise to inflammation of other mucous membranes."*

Diday says emphatically, "*that from the very fact of a woman having a discharge, no matter what its origin, she is liable to give a discharge to a man.*"

Fournier, as the result of his investigations relative to the classes of women from whom gonorrhœa is derived, conceives that gonorrhœa is much less frequently contracted from contagion than from excessive coitus, repeated or prolonged sexual congress, or peculiar excitement during the act.

The opinions of many English Surgeons, particularly those of Mr. Skey and Mr. Henry Thompson, are to a similar effect, that a gonorrhœa is the product of other causes than a specific poison. Those who oppose this view seem to do so upon the grounds that a

* *Lettres sur la Syphilis*, 2d ed. p. 29. On this hypothesis there is, no doubt, much difficulty in explaining how it is that married men so extremely rarely contract gonorrhœa from their wives. It is, of course, very probable that prostitution leads to some changes in the vaginal mucous membrane, by which the character as well as the amount of its secretion is altered; but we possess no observations on which to determine what these alterations, if any, may be.

gonorrhœa is confessedly a highly contagious disease, and that cases of gonorrhœa so caused differ, in the degree and intensity of the symptoms, from a urethritis excited by other causes.

The truth of the latter statement is somewhat questionable; but however this may be, it will not affect the question.

The fact of the disease being so commonly caused by impure sexual intercourse is proof of the presence and action of a poison, but only of such a one as is capable of being produced by simple inflammation. A little consideration will serve to remove the obscurity about this subject.

Opinions have been much modified of late concerning the "specificity" of inflammations. Van Roosbröck's experiments go to prove that an ophthalmia may result from the inoculation of any pus, and that the true morbid property of that fluid depends upon the cells; for when it has been deprived of such by filtration, the remaining liquor appeared innocuous. Mr. Simon, in his essay upon INFLAMMATION (vol. i. p. 69), remarks: "There is ample room to question the popular impression that only specific inflammations are communicable; much reason for suspecting it, on the contrary, to be a generic and essential property of inflammation, that its actions (or some of them) are always in their kind, to some extent, contagious." Mr. Simon quotes from Dr. Guillié's and Sir Patrick M'Gregor's experience upon the occasional contagious properties of infantile and common catarrhal ophthalmia, and cites Dr. Piringer's experiments to the effect that he had succeeded eighty-seven times in exciting conjunctival inflammation by the contact of an inflammatory product (pus), taken from sources the most various.

The experience obtained at some of the London Ophthalmic Institutions is corroborative of the truth of the statement, first made by Van Roosbröck, that as the inflammation, which has produced the pus used for inoculation, has been active and acute, so will the artificial inflammation excited by it be severe in its character.

In this way gonorrhœal pus, applied to the conjunctiva, exhibits far more active properties than pus from most other sources.

It follows from this that the observations of practical Surgeons are borne out by modern pathology, and that a gonorrhœal discharge may be the result of other than specific pus.

There is yet another mode of explaining some of those cases in which an individual has contracted a venereal affection from one in whom no disease can be discovered. The doctrine of "mediate contagion," as it is called, so long regarded as highly probable, has recently received experimental proof at the hands of M. Cullerier. Although the experiments were made with a syphilitic virus, their bearing upon the subject of gonorrhœa is evident.

"Louise Vaudet, aged sixteen, entered the Hospital of Lourcine, ward of St. Mary, No. 9, on the 10th of October 1848. She bore on each thigh an ulceration with a gray floor and abrupt edges. The disease dated a month.

On the 25th of November, after having ascertained beyond a doubt that the mucous membrane of the vulva and vagina was not ulcerated in any part, and that the discharge from these parts was not inoculable, I collected upon a spatula the pus produced by one of the inguinal chancres, and laid it in sufficiently large quantities in the vagina. I made the patient walk up and down during thirty-five minutes, taking care to watch her, so that she might not place her hand on the vulva. After this lapse of time, I placed upon a lancet a certain quantity of the vaginal secretion, and I inoculated with it one of the patient's thighs. I then washed with water the vagina and vulva; I carefully wiped the parts, and then washed them again with a strong solution of alum. Forty-eight hours after, the puncture of inoculation had produced a characteristic pustule. I left it till next day, so that the experiment might be more certain, and then destroyed it with Vienna caustic. Nothing whatsoever appeared in the vagina; the inflammation was not increased; and after two months the patient quitted the hospital perfectly cured of the vaginitis, as well as of the inguinal ulcerations.

The second experiment was made upon Celestine X—, aged twenty-four, who entered Lourcine, ward of St. Louis, No. 7, on the 28th of November 1848. She bore on the left thigh an ulcerated bubo of two months' date, and which, according to her, had succeeded a pimple, seated on the internal surface of one of the labia majora, which had only lasted for a few days. At the time of her admission into the hospital no trace could be discovered of this pimple. The vulva, the vagina, the neck of the uterus, and the anus were all in a perfectly normal state. The aspect of the ulceration on the thighs made me suppose that it was specific. On the day following, the 29th, the pus proceeding from the bubo was placed upon a spatula and laid in the vagina, care being taken to carry it as high as possible. The patient was then made to walk about for an hour, without knowing that she was the subject of an experiment. She was taken back to bed; and I then collected as much as I could of the vaginal mucus, remarking to some pupils and young colleagues who surrounded me, that none of the pus introduced into the vagina could be seen, and that what I had on my lancet was entirely similar to the normal mucus. I inoculated one of the thighs, using the same precautions in washing as I did in the former case. After two days, the characteristic pustule rose, and I only destroyed it after forty-eight hours. The vulva, vagina, and the neck of the uterus were carefully observed during several days, but nothing appeared; the disease restricted itself to the thigh. I must not neglect to say, that although there was no sign of disease in the interior of the organs of generation, yet I made on the same day an inoculation with the mucus with which they were covered, and obtained a negative result.*

From these observations it results that a female may be the vehicle of disease without being herself affected; and that a virulent pus may be retained in contact with the vaginal tissues for a certain time without producing that diseased action which it is capable of inducing elsewhere.

Seat and progress of the disease. Gonorrhœa or blennorrhagia is an inflammation, ordinarily acute, of the mucous membrane of the urethra or some other parts of the genito-urinary tract, and accompanied by a muco-purulent or purulent discharge. In the male it comprehends varieties according as it is located in the urethra, upon the prepuce or glans penis. It may be confined to one of these parts only, or occupy more than one, or all, at the same time.

Gonorrhœa of the nose, mouth, anus, &c. have been described; but the existence of these is open to question, and they are relatively of such rare occurrence that we may, practically, altogether discard them.

Differences of opinion are entertained as to the exact seat and extent of the disease in the male urethra; some conceiving that it commences exclusively at the fossa navicularis, others at a part more posterior; while Astruc

* Condensed from Dr. Cullerier's work, *Des Affections Blennorrhagiques*, 1861.

thought that it had its special seat in the various glands and the reservoirs. No doubt some differences will be found to exist in different cases, alike as to the extent of the membrane involved and the acuteness of the inflammatory process.

The ordinary seat, however, of the disease is in the more superficial layers of the mucous membrane, and the inflammation affects the orifices of the follicles and lacunæ in the urethra. It commences, for the most part, at the fossa navicularis and the neighbouring mucous membrane, and, as it advances, spreads backwards, by contiguity and continuity of tissue, to the posterior extremity.

The points at which the inflammation remains most commonly fixed, and in which it is manifested with the greatest intensity, are the fossa navicularis and the vicinity of the bulb. The appearances noticed by Hunter, Sir Astley Cooper, and Ricord, in their dissections, were those of inflammation of the urethra without breach of surface; and these appearances were most marked within two inches of the meatus and at the bulb. Although this is an adequate expression of the seat and extent of the inflammation in most cases, with some it is far otherwise.

Gonorrhoeal inflammation does not ordinarily affect the whole of the urethral mucous surface, but in some cases, as Wallace remarks, it may be diffused over a wide surface, and "may involve at the same time the whole of the urethra, the bladder, the testicles, the glans, and prepuce, in the male; and in the female, the nymphæ, clitoris, labia, vagina, &c.; and thus commencing at the preputial end of the penis, in the fossa navicularis, it not unfrequently creeps slowly on to the posterior parts of the urethra, to the bladder, or to the testicles, while it decreases or ceases entirely in the parts first affected."* It may be confined to the mucous membrane only, or extend to the tissues beneath. Sometimes it would appear that the inflammation is localised to some part of the canal, inducing thickening and effusion into the sub-mucous tissues, and maintaining for a long period a scanty purulent or gleetly discharge.

In the chronic stages, the mucous membrane may become granulated like the palpebral portion of the conjunctiva in chronic ophthalmia.

GONORRHOEA IN THE MALE.

Men are much more liable to contract this disease than women.

The first attack is generally the most severe, and a kind of tolerance of the disease is commonly found to follow repeated attacks. The symptoms usually appear from the second to the fifth day after exposure; sometimes, though rarely, at later dates.

The progress of the disease may be conveniently divided into four stages.

I. The symptoms are at first very slight, consisting of an itching or tickling sensation of the meatus; this is found rather more florid than normal, and the lips of the canal are glued together by a small quantity of viscid colourless secretion. This moisture augments in amount, but continues scanty, and passes from the clear watery appearance to one of opalinity. Slight puffiness of the lips of the

* Wallace, *Treatise on the Venereal Disease*, pp. 237, 238.

meatus appears at this time. There is no ardor urinæ at this stage, but only such modifications of sensation as amount to a trifling smarting.

This stage may last from a few hours to two or three days.

The inflammation, such as it is, is both very incipient in degree and limited to the neighbourhood of the meatus and fossa navicularis.

This is the premonitory stage.

II. The symptoms gradually increase in intensity until a highly inflammatory condition is reached. The mucous membrane of the glans is swollen and inflamed, and the entrance of the meatus appears also swollen and florid. Sometimes there is œdema of the prepuce, slight in degree, or sufficient to cause phimosis. The discharge augments rapidly in amount, loses its opaline character of muco-pus, and becomes a thick creamy pus with a tinge of green. The penis and course of the urethra feel tender and swollen to the touch. The slight smarting increases to a severe degree of scalding in passing the urine. The patient voids it with difficulty in a smaller or forked stream; oftentimes it makes its exit in jerks, alternating with the spasms of the muscles lining the urethra. When the mucous membrane about the bulb is affected, the patient suffers from pain and weight in the perineum, which are augmented in voiding his urine.

At night, when the sufferer becomes warm in bed, he is liable to attacks of involuntary erection and chordee. This latter term is applied to that arched or bent position which the penis assumes in erection. The explanation generally given of this phenomenon is this: The urethra, the chief seat of the inflammation, runs along the under surface of the penis; the lymph, which is apt to be effused around this canal, renders it less extensible than that portion of the organ composed of the corpora cavernosa; hence, in a state of erection, the corpus spongiosum surrounding the urethra, not yielding to the distension, acts like the string of a bow, and chordee is produced. Mr. Milton conceives the mechanism of chordee to be due to spasm of the muscular fibres, described by Mr. Hancock and Professor Kölliker as surrounding the whole course of the urethra.

Abscesses occasionally form in the areolar tissue surrounding the urethra, either anteriorly to the scrotum or in the perineum. It is not uncommon, also, for one of the lacunæ of the urethra to inflame, suppurate, and form a small abscess (lacunar abscess).

This stage lasts from one to three weeks; the continuance or not of inflammatory phenomena depending very much upon the

constitution of the individual, his mode of life, and the number of previous attacks.

The disease, having ascended by a rapid course to a period of maximum severity, gradually subsides and loses its more acute symptoms.

III. This is the stage of decline; the symptoms and discharge having run through the same phases, in an inverse order, which they did at the outset of the attack. There is a marked diminution or entire cessation of scalding in passing water; the penis is no longer hot, painful, or tender; the involuntary erections and chordee being absent altogether, or, more commonly, of less frequent occurrence. The discharge slowly diminishes in amount, partaking less and less of the characters of pure pus, and, before disappearing, becoming almost entirely mucous.

This stage is both longer and more uncertain than the preceding ones. It being one of discharge without much inflammation or any marked complications, it may be readily conceived that these are easily excited and are prone to occur.

IV. The last stage does not occur in all cases. It is known by the name of blennorrhœa or gleet, and comprehends a slight but chronic discharge from the urethra, unattended by symptoms of inflammation.

It is impossible accurately to define a line of separation between this and the previous stage, which it generally follows without interval.

A very scanty discharge occurs every morning upon rising from bed, and the lips of the urethra appear gummed together. By pressure, perhaps a small amount of matter can be expelled. The characters of this discharge will vary according as it is the product of a chronic inflammation of some part of the mucous membrane alone, or mixed with the various glandular secretions. Sometimes it is a glairy mucus; sometimes a concreted pus, or a prostatic secretion, or a combination of these. This state is liable to be increased, and attended with irritability of the urethra or bladder, under the aggravation of some such exciting causes as coitus, a debauch, &c.

There are no further symptoms; but the disease is apt to prey upon the patient's mind, and so derange his health and assimilative powers. Haunted by his fears and morbid suggestions as to impotence, he may be deemed fortunate if he escapes the clutches of some advertising charlatan.

Gleet is often the result of an imperfectly-cured gonorrhœa;

sometimes it is due to a localised chronic urethritis of the bulb, organic changes within the urethral canal, such as stricture, or mucous vegetations, or it is maintained by an implication of some one or other of the glands in a blennorrhœal inflammation.

From whatever source it arises, it is liable to be kept up by certain bodily conditions, congenital or acquired, such as a general debility or delicacy of constitution; a strumous, rheumatic, or gouty diathesis; or a lymphatic temperament.

Hunter, in his work on the *Venereal Disease*, speaks of gleet as perfectly innocent with respect to infection; and adds that in the relapses, which so frequently occur, the virus, in his opinion, does not return. Nothing can be more dangerous than the practice which would follow from such a doctrine. Even if the purely gleetish discharge were proved to be innocuous, we know that it is liable to a puriform change upon many and apparently slight exciting causes, and then it would, without doubt, be capable of inducing disease in another. So long as *any discharge exists*, sexual congress is unsafe.

Pathology. While the gonorrhœal inflammation attacks very commonly the straight part of the urethra, and may indeed go no further, the gleetish discharge is more frequently the product of changes going on at a deeper seat—the neighbourhood of the bulb.

Mr. Thompson remarks: "Observation demonstrates that the two spots which suffer most from gonorrhœal inflammation are the fossa navicularis and the bulb; I have had opportunities of observing this two or three times in the dead-house, on the bodies of patients who had been suffering from gonorrhœa shortly before death. Unusual vascularity is found in the latter situation, particularly if the affection have been chronic, while the intermediate part appears comparatively very little affected. There is a preparation in the Museum of St. George's Hospital which exhibits the urethra of a patient who died while suffering from gonorrhœa, in which an ulcer exists (the only one to be seen) in the commencement of the membranous portion."*

A well-marked attack of gonorrhœa in the male may be termed a severe local disease, and rarely terminates in less than three months if no treatment has been applied.

The reaction of the disease upon the system varies very much in different individuals, and in different attacks in the same person. In some cases, a well-marked pyrexial state attends the inflammatory stage of the complaint. Generally, however, there is a comparative if not entire absence of constitutional symptoms. There is certainly a marked tendency to depression of the general health; anæmia is induced, and the sufferer has a pallid and listless appearance of face. These effects will be more markedly evidenced in delicate subjects.

* *Stricture of the Urethra*, p. 84.

Varieties of the disease. A variety of gonorrhœa has been described as a "gonorrhœa sicca." It must be very rare, and it has not fallen within the observation of the writer. The symptoms would be those of inflammation, such as heat, redness, and swelling of the parts, with scalding in voiding urine and painful erections, but without the discharge which forms so prominent a character of the ordinary form of gonorrhœa.

Gonorrhœa externa, or balanitis, is an inflammation of the surface of the glans and mucous lining of the prepuce, attended with profuse discharge. It may arise from the same causes as the urethral form, and is particularly apt to occur in persons possessing a long prepuce. A similarly diseased state may be induced by want of cleanliness; a retention and decomposition of the secretion from the preputial glands; and sometimes it occurs as an indication of disordered health.

In severe cases, the prepuce may rapidly inflame and swell, with great pain and febrile symptoms, phimosis being induced. In chronic balanitis with phimosis, the mucous lining of the prepuce is frequently found, upon exposure, to be rough, fleshy, and studded with granular prominences.

Excoriations and erosions of the glans and prepuce are frequently present, and it is of great importance to remember that a balanitis with such erosions may be the precursor to general syphilis.

Upon the glans penis an erosion or rawness is often only a primary sore, and induration of the preputial tissues may appear subsequent to the healing and at the base of the excoriations, so that we must always give a very guarded diagnosis and prognosis.

The treatment of this variety may be summed up at once. It consists of perfect cleanliness with frequent injections of warm water or an astringent lotion. Lime-water is a good application when there is much inflammation. When there is much discharge without great inflammation, dusting the parts with a mixture of finely-powdered calomel and calcined magnesia is a capital treatment. It can be applied at night, and removed by an astringent wash in the morning.

If the excoriations have not healed in a few days, a solution of nitrate of silver (gr. xx. to oz. j.) will generally answer the purpose. A saline aperient and rest are often indicated.

Before passing to the general question of the treatment of the disease, we must briefly notice several complications which may occur.

1. There may be severe irritation or actual inflammation of the urinary organs, sometimes of the deeper portion of the urethra, producing great pain in the perineum, with spasm of the external and internal layer of muscles, during micturition, which causes such pain

and difficulty in voiding the urine as to amount occasionally to complete retention; sometimes of the bladder, causing a constant desire to make water, pain in doing so, which lasts for some time afterwards, together with mucous deposits in the urine; or there may be symptoms of renal irritation, marked by pain in the loins, pyrexia, vomiting, and bloody, albuminous, or purulent urine. This state, with or without symptoms of vesical inflammation, is likely to be induced by strong or untimely injections, absence of rest, alcohol, and the use of large doses of *copaiba*.

2. *Hæmorrhage* from the urethra. This is likely to occur during *chordee*, or violent erections, from rupture of some of the distended vessels. It is rarely large in amount, and exercises a beneficial influence rather than otherwise. In passing, it may be remarked, that the green hue of the urethral discharge is probably due to altered hæmatine being mixed with the pus.

3. Inflammation, leading to suppuration of some of the mucous follicles of the urethra. Sometimes this is confined to a follicle; sometimes an abscess forms both in this and the neighbouring tissues subjacent to the mucous membrane. The swelling thus arising may greatly impede the flow of urine, until it bursts either into the urethra or externally.

4. Inflammation of the lymphatic glands—constituting some form of *bubo*. *Buboes* generally make their appearance during the second or inflammatory stage. They are of rare occurrence, except in persons of delicate constitution and lax habit, or when the patient has neglected to rest during the disease. One or more inguinal glands enlarge and become tender, causing uneasiness in the erect position. The areolar tissue and skin around such glands become red and inflamed. If the patient maintains the recumbent posture, and counter-irritation—such as painting the part with a strong solution of iodine, or a blister—be applied, an abscess is generally avoided. In strumous, lymphatic, and debilitated subjects, an abscess will sometimes occur; or one of the glands will become much and chronically enlarged, the superimposed tissues slowly inflame, and abscess with sinuses may follow.

The lymphatics along the dorsum of the penis may be affected also. The vessels can be felt enlarged, but not indurated, as in chancre; the areolar tissue about them inflames, and the skin is generally engorged and red; the pain and tenderness are plainly marked; and sometimes an abscess forms at the root of the penis. When an involuntary erection occurs, these inflamed lym-

phatics may prevent the equable expansion of the organ, and give rise to a modified form of chordee.

5. Balanitis has been already alluded to.

6. Phimosis and paraphimosis may likewise ensue.

The terms *phimosis* and *paraphimosis* are applied to two exactly opposite conditions of the penis. In the first it is difficult or impossible to retract the prepuce behind the glans penis so as to uncover it; while in the second the difficulty arises in returning the prepuce so as to cover that part of the organ.

Cases of phimosis are referable to three heads: 1st, congenital; 2d, accidental, or acquired; 3d, and not unfrequently, a combination of these two causes, as when some inflammatory disease has attacked the tissues of the prepuce or glans, and so either diminished the calibre of a naturally narrow orifice, or increased the dimensions of the contained part.

The congenital form is very common. In some cases there is not only a narrow orifice to the prepuce, but this is associated with adhesions between the opposed mucous surfaces of the glans and its covering. The majority of cases, however, are dependent upon the narrow orifice; at the same time there generally exists a redundancy of preputial tissue.

Although this congenital condition is compatible with perfect health, and may give rise to no obvious inconvenience, still it is a frequent source of this, as well as irritation from a retention of the secretions, and must without doubt increase the liability to disease from sexual intercourse.*

Most Surgeons have witnessed cases in which, where this congenital formation has not been interfered with, it has given rise to some impediment to the discharge of urine; in a few rare instances this may be so great that the prepuce becomes the receptacle for a certain amount of urine; when this condition has been a chronic one, the preputial tissues may become much hypertrophied and distended from this retention of urine and the irritation which it sets up. Various and manifold are the symptoms and diseases which have been referred to congenital phimosis. Into these there is no space to enter; but we may name one as fairly substantiated: it may give rise to atrophy of the glans from impeding its normal growth and development.

Among the evils to which an elongated or adherent prepuce

* See Mr. Hutchinson's interesting statistics upon syphilis as affecting the Jews, *Medical Times and Gazette*, Dec. 1, 1855.

may give rise, there ought to be mentioned vesical irritation, incontinence, or even retention of urine. In young children, prolapsus recti may further complicate the symptoms. The suspicion of calculus, of course, arises in such cases, which are not infrequent in the practice of large hospitals. The removal of the prepuce by circumcision, and the careful separation of the prepuce from the glans penis, will suffice to cure them.

Acquired phimosis depends upon some inflammatory or other disease of the prepuce or glans—particularly in those who naturally possess a long and narrow prepuce. Such an inflammation will give rise to swelling of the glans, or thickening or contraction of the prepuce. Of these accidental causes we have, besides balanitis (whether idiopathic or connected with chancres), secondary sores, vegetations, &c., the widely-spread induration of a chancre, and the contraction arising from the cicatrisation of these, more especially when they have been seated upon the margins of the prepuce.

In relation to this subject the writer may remark that, although he has never himself seen phimosis so produced, he has occasionally noticed a localised hypertrophy of the preputial tissues as a sequence of chancre of those parts. This consists of an ill-defined, diffused thickening, with or without a small amount of œdema, and is essentially chronic. Of course such a state might induce phimosis.

The treatment will be operative or not, according to the cause and degree of the affection. If the glans can be uncovered, then the habit of doing this, with attention to cleanliness, will often be sufficient. In the congenital form, the operation of circumcision may be at once performed; such is not the case, however, in the forms depending upon accidental causes. The surface of a wound is apt to be inoculated with the fluid secretions from those temporary affections which have caused the phimosis. The same remark applies to the application of leeches to the inflamed prepuce—which should never be done. By rest, fomentations, a saline purge, and the repeated injection of tepid or cold astringent lotions, or the remedies necessary for the healing of any ulcer, the inflammatory swelling and, with it, the phimosis, disappear; if not, we have recourse to operation.

The operations for phimosis are of two kinds, according as we seek to reduce the length of the prepuce at the same time that we give it a free movement over the glans penis, or as we simply desire to effect the latter object.

Circumcision is the operation required in children, and it is best adapted for adults also when the skin is redundant and the margins of the preputial opening are thickened. Different plans of operating have been devised. One of the simplest and best is the following:—

The prepuce is to be seized with the fingers, or a pair of forceps, at its orifice, and drawn sufficiently forwards, when an assistant grasps and compresses it with a stout pair of forceps immediately in front of the glans. The skin being thus put upon the stretch, it is severed with one stroke of a bistoury immediately in front of the forceps. The mucous lining, which will be found to be still undivided and covering the glans penis, is then to be cut up-

wards from the orifice, by means of a pair of blunt-pointed scissors, or by a bistoury on a director, and the frænum is to be snipped through if necessary. Any small arteries are to be tied, and the mucous and tegumentary surfaces are to be connected with interrupted sutures, five or six of which will be necessary. If any adhesions exist between the mucous surfaces of the glans and prepuce, these are to be divided, or torn through by stripping the roll of membrane of the latter off the former. In adults circumcision is the best method of proceeding, as it leaves little or none of that disfiguration which is apt to follow the division of the prepuce simply.

When the prepuce is of natural length and appearance, except that the orifice is painfully tight, Mr. Fergusson recommends, that "the point of a director should be pushed in front, between the glans and prepuce, about half an inch up, and then a narrow sharp-pointed bistoury should be thrust through, from within outwards, and carried downwards, by which means a wound half an inch in length will be made in the skin. The incision in the mucous membrane will then scarcely appear so long as that in the skin, and it should be lengthened with scissors, and then two, three, or four stitches should be introduced with a fine needle." It is unnecessary, as well as a cause of deformity, to divide the parts as high as the corona, as some do, for half an inch answers all purposes. Instead of the above plan it has been recommended to make two, three, or four small cuts through the mucous membrane and prepuce at different parts of its edge. This is at least quite as painful, and certainly a less satisfactory method than that described.

It may be well to add a word or two in the way of caution about these simple operations. 1. Sutures ought always to be employed to bring the parts together, with the view of expediting the process of healing, and preventing the contraction which is apt to ensue when the wound is left to heal by granulation. 2. When circumcision has been performed, the small arteries—particularly any in the neighbourhood of the frænum—should be ligatured at the same time, because these are apt to bleed profusely afterwards, when the patient gets warm in bed, &c., and so consequences very unpleasant to him and the Surgeon will ensue. 3. In cases where the phimosis has resulted from disease, and where the prepuce is inflamed, œdematous, or where we have reason to suspect concealed chancres, it is well not to operate, because the wound will very likely be inoculated, and take on an unhealthy action, but we ought to endeavour to overcome the phimosis by proper treatment. Of course, in some cases the division of the prepuce is essential, not only for the discovery and treatment of the diseases which it conceals, but in order to prevent or limit a destruction which may be threatening from the pressure and constriction of the engorged prepuce and the retention of foul discharges beneath it.

The condition known as *paraphimosis* occurs thus: a narrowed and difficultly retracted prepuce, perhaps, is drawn beyond the prominent edge of the corona glandis; in a short time the circulation becomes so impeded by the pressure of the constricting preputial orifice, that tumefaction ensues, with the effusion of serum and lymph, to such an extent as to bury the seat of stricture in a deep furrow. The consequences will then depend upon the tightness of the stricture, its duration, and the amount of inflammatory swelling; ulceration, or extensive sloughing may ensue, by which the stricture is relieved at the expense of much loss of tissue and horrible pain.

If we look at the penis so affected, we notice that immediately behind the glans there is a prominent roll or collar of mucous mem-

brane, with another, though less prominent, swelling of the integument beyond this, separated, the one from the other, by a narrow line or furrow. It is at the bottom of this furrow that the constricting cause is seated.

This affection is not uncommon in boys.

The treatment will consist in reducing the parts to their normal position without delay. We may apply ice, or direct a stream of cold water upon these so as to constrict them as much as possible.

As the proceeding for reduction is, in most cases, extremely painful, chloroform may be used. The patient is to be placed upon his back: the glans penis is to be well oiled, and covered with a piece of thin rag. With the fingers of the right hand the glans is to be gradually, but firmly, compressed so as to diminish its size: at the same time, with the left hand encircling the body of the penis, the integument is stretched and drawn forwards, while the compressed glans is pushed backwards through the narrow ring.

Should this not succeed—which it generally will—the seat of stricture can be divided by directing a narrow bistoury flatwise beneath it, and then turning the edge upwards; or by cutting through the stricture upon the dorsum of the penis at the bottom of the furrow. It may be necessary to do this in more than one place, and at the same time to evacuate effused fluids by scarifications and punctures.

Chronic inflammation of the prostate is an occasional result of gonorrhœal or gleet inflammation.

To Mr. Adams's work* the reader is referred for a very full and admirable description of it, as well as to an excellent article by Mr. Ledwich.† See also DISEASES OF THE URINARY ORGANS, p. 363.

The inflammation is blennorrhœal in type, leading to the discharge of a clear, transparent, or slightly turbid viscid mucus.

This discharge may be sufficient to stain the linen, and is very apt to escape during the act of defæcation. It is *not* semen, as it contains no spermatozoa. The disease gives rise to a sense of weight in the perineum, symptoms of irritability about the neck of the bladder, a peculiarly exalted sensibility of the prostatic portion of the urethra on passing instruments, and is almost invariably accompanied by physical and mental languor and depression of spirits, sometimes amounting to hypochondriasis.

The treatment will consist mainly in obtaining the patient's confidence, and disabusing his mind of morbid fears as to impotence. Attention to hygiene is important; sea-air and bathing, exercise, the regulation of the bowels by cold-water enemata or an occasional dose of sulphate of magnesia, the use of a full-sized bougie or sound, and the administration of the remedies indicated for gleet—particularly turpentine, the muriated tincture of iron, strychnia, and tinctura lyttæ. If these fail, Lallemand's porte-caustique may

* *Anatomy and Diseases of the Prostate Gland*, 1853.

† *Dublin Quarterly Medical Journal* for August 1857.

be used. The author has found considerable benefit in these cases from touching the prostatic portion of the urethra with dilute solution of the perchloride of iron. This does not give the pain, and is free from some of the other inconveniences attending the use of caustic.

Gonorrhœa is not, ordinarily, attended or followed by any cutaneous diseases. The writer has, however, noticed the appearance of a papular erythema in many cases—not depending upon the administration of balsam of copaiba. The subjects of it were suffering from those dyspeptic symptoms so very commonly present in diseases of the genito-urinary organs, and, in the writer's opinion, the eruption was symptomatic of the gastric disease. It is characterised by dull red or pinkish-yellow spots, of various but medium size, and sensibly elevated above the surface. The colour disappears under pressure of the finger, and slowly reappears upon its removal. Sometimes these spots are mingled with the larger wheals of urticaria. The eruption is rather sudden in its appearance; ordinarily does not last more than a few days, and leaves no copper-staining.

Herpes preputialis is not an uncommon affection, and requires a few words of comment here, on account of the similarity of its appearance to the incipient forms of primary chancre.

It is known by the appearance of small vesicles upon the internal or external surface of the prepuce.

The disease commences in the form of several red inflamed spots, upon which minute globose vesicles appear. These vesicles are generally arranged in groups or clusters of two, three, or four.

The affection runs the ordinary course of herpes, but the serous fluid, instead of being absorbed, becomes sero-purulent, and (after rupture of the vesicle) desiccates into a thin scaly incrustation, or leaves an extremely superficial erosion. A circle of vesicles sometimes surrounds the orifice of the prepuce, which is then apt to become fissured and abraded. This affection is accompanied by more inflammation when seated upon the mucous membrane than upon the external skin, but rarely lasts longer than four or six days.

According to Dr. Burgess a similar herpetic affection attacks females about the pudendum, appearing upon the external aspect of the vulva or on the mucous membrane internally; and may be mistaken for prurigo.

The diagnosis from incipient chancre—not by any means always easy when the period of observation is very limited—will be determined by the number and appearance of the vesicles, their arrangement in groups, the non-inoculability of their fluids, and their speedy

cure by simple remedies, such as sulphate-of-zinc lotion (gr. iij.-iv. to oz. j. aquæ), with a little lint for protection against friction.

7. Epididymitis, or swelled testicle, gonorrhœal rheumatism, and the two forms of ophthalmia—one an acute purulent conjunctivitis; the other an affection of the deeper fibrous textures of the eye, rheumatoid in character, and allied to gonorrhœal rheumatism—are treated of in other essays.

For the sequelæ of gonorrhœa, such as stricture, spermatorrhœa, warts, &c., the reader is referred to the essays on DISEASES OF THE URINARY ORGANS, of the MALE ORGANS, and of the SKIN.

The diagnosis of gonorrhœa is not ordinarily attended with any difficulty. When there is phimosis, the discharge may be furnished from the urethra, or from chancres within the prepuce, or both. We must feel for any localised sore or hardness, examine into the state of the inguinal glands, or wait until, by rest and soothing injections, the prepuce can be retracted.

The diagnosis between gonorrhœa, and a primary syphilitic lesion of the urethra so deeply seated as to be undiscoverable upon forced dilatation of the meatus, is difficult, if not impossible. But it has not as yet been proved that a true Hunterian or infecting chancre ever occurs at so great a depth in the urethra; and the diagnosis between a non-infecting sore and gonorrhœa would not be equally important.

Treatment of gonorrhœa. First stage. Abortive treatment. We are met at the outset by a question as to how far this is justifiable. By one party the practice is as loudly vaunted, as by another it is utterly condemned. If truth ever rests in extremes, the latter contains the largest measure of it: but the question really lies between the indiscriminate use and abuse of remedies to this end, and their judicious application in carefully-selected cases. This much may be safely said, that, in practice, it is rare to meet with cases at a sufficiently early stage to justify the use of injections.

When, however, the symptoms are such as have been described and no more, the use of astringent injections will no doubt often abort the progress of the disease.

Considering the severity of gonorrhœa as a disease, its duration, the complications to which it may give rise, and the loss of health and strength which it entails, we are justified in making an attempt to curtail its progress at the commencement.

Spite of the sanction of such names as Carmichael of Dublin and M. Diday, the writer objects to the use of strong solutions as injections, believing them to be incomparably more dangerous, and no more efficacious than weaker injections. He is in the habit of using these remedies of a strength and nature as recommended by Mr. Langston Parker (e.g. solutions of nitrate of silver gr. j.-ij. to oz. vj.; solutions of sulphate of zinc gr. iv.-viij. to oz. viij., or diacetate of lead scr. j. to oz. viij.); and as far as his experience extends he has seen no cause to regret their application.* Unless the injection be properly applied to the diseased

* On the use of weak injections, frequently repeated, see a paper by Mr. M. H. Collis, *Dublin Quarterly Journal*, Feb. 1, 1863.

surface no good can result ; and the Surgeon should do this himself at first, and see that the patient is properly instructed in the mode. Glass syringes, properly selected, or hard india-rubber ones, may be used. The patient should have passed his water a short time beforehand, and be directed to avoid doing so directly afterwards. The distance to which the injection is to penetrate may easily be regulated by compressing the canal at the required point. The injection should be used every three or four hours, and the patient seen at least once daily by the Surgeon. He should be directed to remain recumbent as long as possible, to live upon a farinaceous diet, and to avoid meat, condiments, coffee, and all stimulants, particularly beer. If the bowels have not been already acted upon, it is right to begin with that, and to prescribe an antimonial saline mixture, containing sulphate of magnesia, potassio-tartrate of antimony, and acetate of potass, in sufficient doses to nauseate slightly and relax the bowels without active purging. The patient is better also for drinking plentifully of any diluents of a mucilaginous nature.

The discharge is augmented after the first few hours' use of the injection, and the urine scalds. By about the second day the discharge is perhaps slightly tinged with blood. The injections should be at once stopped; but the medicine, and precautions as to rest and diet, require more than ever to be attended to.

From this period, if the practice is to prove successful, the discharge will diminish, and in about three or four days cease. Should it, however, be diminished, but nevertheless continue, and either no, or very trifling, inflammatory symptoms be present, and still limited to the neighbourhood of the meatus, the patient may use a weak solution of sulphate or acetate of zinc. Merely washing out the urethra frequently with tepid or cold water is very useful, inasmuch as the contact of the secretion is by itself a cause for the propagation of the diseased action. If the smarting be such as to render the further use of injections doubtful, these ought at once to be relinquished, or replaced by an injection of sub-nitrate of bismuth with a little extract of opium and mucilage. These ingredients act as a local sedative and mild astringent, besides forming a coating to the sensitive mucous membrane.

It is to be distinctly understood, then, that the stage to which these agents are applicable is always a very limited one, and varies somewhat in different cases ; that their use presupposes an absence of inflammatory symptoms ; an absence of pain in passing water, as well as of any such swelling of the lips of the urethra, as to cause pain or difficulty in inserting the nozzle of the instrument.

Some persons use at this stage large doses of such anti-blennorrhagics as copaiba or cubebs. This is a practice of which the writer has failed to appreciate the utility, and which he considers injudicious, as in almost every case a good deal of derangement of the digestive system ensues from the use of them, and, not infrequently, symptoms indicative of congestion and irritation of the kidneys.

If, however, any one thinks that he makes "assurance doubly sure" by their administration, let him use a preparation of cubebs, which is almost entirely exempt from these liabilities to mischief.

Second, or acute stage. In the first place, to secure perfect rest in the recumbent posture is most important. In practice, unfortunately, this often cannot be done. All exercise should be avoided, as far as possible. The genital organs should be properly supported in a well-fitting suspensory bandage.

The diet should be scrupulously low and unstimulating, as a rule throughout, to which there are no exceptions at the commencement of this stage. The bowels should be well opened, and during the treatment maintained in a relaxed state. Should the inflammatory symptoms be markedly severe, and out of proportion to the amount of discharge, and at the same time attended with much spasm of the urethral muscles, and scalding in voiding urine, the application of six or twelve leeches to the perineum affords great relief, although their application is not absolutely necessary.

The patient should either not wear pieces of lint over the meatus, between

the glans and foreskin, or very frequently indeed change these. The contact of lint soaked with pus is apt to induce balanitis and phimosis, if it have not also an injurious effect upon the urethral mucous membrane, by impeding the exit of the discharge.

Of the local applications, none is better nor more soothing than that recommended by Mr. Milton, viz. the application of water, as hot as can be borne, to the genital organs.

The patient should drink frequently barley-water or linseed-tea, to which some mucilage has been added. At this period, saline diuretics, alkaline in character, are almost essential. The writer prefers a mixture of acetate of potass, tincture of hyoscyamus, and nitric ether, to which a small amount of antimony may be added or not. As soon as the scalding in micturition, swelling of the penis, and urgent symptoms are subsiding, the anti-blennorrhagics may be commenced. Their administration, upon the one hand, before the decline of inflammatory symptoms would be most injurious and injudicious; but, upon the other hand, we need not wait until the absence of such symptoms in the third stage is pronounced. If the balsam of copaiba be used, we need not exceed one-drachm doses, three or four times daily; and half that quantity may be used at the commencement.

One of the most useful forms for the administration of copaiba is that in which the balsam is combined with sulphuric acid. Fifteen minims of dilute sulphuric acid may be added to half a drachm of copaiba with some infusion of roses and mucilage. The medicine will act with more certainty in this way, will be better tolerated by the stomach, and will not be so disagreeable to the taste.

The administration of copaiba in any form will occasionally be followed by a rash upon the skin. This often causes the patient great uneasiness, as he fancies that he is affected with secondary symptoms. The rash appears suddenly in small red patches, more or less circular, and somewhat resembling the ordinary nettle-rash in character. It never produces any serious consequences, and generally its appearance is followed by diminution of the discharge and other local symptoms. When this rash makes its appearance the use of the copaiba is usually discontinued, and a saline purgative ordered. If it be desirable to remove the eruption speedily, a warm bath will usually accomplish the purpose.

During the inflammatory stage injections are quite out of the question; but if the scalding be not very great, and the lips of the urethra not much swollen, there is no objection to injecting, with great gentleness, a tepid solution of the extract of opium, or, as directed by Bumstead, this with the addition of glycerine.

The most efficacious plan of treating chordee when it arises embraces the following points: To see that the patient has a well-ventilated room, and is as lightly covered with clothes as is consistent with comfort; the avoidance of any supper or drinks for some hours before bedtime, and the use of a hard mattress; to direct the patient, on going to bed, to bathe the parts with very warm water, and to continue to do so until a sensation of faintness is induced, if possible. Of the medicines directed to the prevention of this symptom, the best is camphor in a liquid form, as directed by Mr. Milton (one drachm of the tincture in water before going to bed, and a repetition of the dose every time the patient wakes with chordee). Lupulin may also be given, in ten or fifteen grain doses, before bedtime. It is less likely to disagree with the patient, but is inferior as a remedy to camphor.

Third stage. The most important part of the treatment of this stage consists in the use of injections, at the same time that copaiba, cubebs, or other remedies are administered.

Very different opinions have been expressed as to the use of injections. By some it is thought that these are a fruitful source of stricture. A certain amount of truth appears to be present in this opinion; for of the soldiers treated in H.M.'s army-hospitals, but few suffer from stricture; while among

officers, who use injections to a far greater extent, stricture is not infrequent. This is only apparent, however; for a structural change in the urethral tunics is the result of some preceding inflammatory process; and the more chronic such morbid process has been, the more likely it is that stricture will result. So far as injections are curative of inflammation, so far will they tend to prevent the occurrence of stricture. When by injudicious use they have aggravated or maintained the existing disease, or when they have produced a temporary freedom from discharge, and the patient has been deceived, on this very account, into believing himself cured and has acted accordingly, no doubt they may so far tend to the production of stricture.

The writer firmly believes that, if used with ordinary care and judgment, injections are among the very best and most reliable agents we possess for the cure of gonorrhœa.

It is to the third stage of the disease that they are particularly applicable; and the following is a sketch of the writer's plan of treatment of that stage.

The urgency of the inflammatory symptoms passed, but the entire absence of such symptoms not pronounced, the patient should commence with an injection of bismuth and mucilage (bismuth subnitr. x. gr. to j. oz. aquæ), to which a little morphia, extract of opium, or belladonna, has been added. This may be used thrice daily, and the patient be directed to cleanse the urethra also by an occasional injection of cold water. After a few days, this injection is to be exchanged for one of sulphate of zinc (j. gr. to j. oz.), and the strength of this gradually increased to iv. grs. to j. oz. If the patient has progressed to a certain extent with this, but then remains stationary, a variety of injections may be tried, inasmuch as change in itself appears useful. The chloride of zinc injection, as recommended by the late Mr. Lloyd, is an excellent one (j.-iv. grs. to iv. oz.). The injection so long in use at the old Lock Hospital, of sulphate of zinc and acetate of lead, xxx. grs. of each to vi. oz., is a very good one. Alum and vegetable astringents are of inferior efficacy. The writer does not commonly use nitrate of silver as an injection; but if others have been tried, a weak solution (j.-ij. grs. to j. oz.) may be used.

The next most important local measure is the occasional use of bougies. The bougies may, before being introduced, be covered by different kinds of ointment or by the balsam of copaiba. The writer much prefers the metallic pliable instruments for this purpose. An instrument should be selected of sufficient size to adapt itself to the urethra without distending it; and this should be passed (with the utmost gentleness) twice or thrice weekly. The writer has obtained excellent results from this combined plan of treatment.

If scalding be present, the bougies should not be used at all; if their introduction induces spasm, the attempt must be made at a later date, or the instrument may be left, as far as it has passed, in the hands of the patient for a few minutes, when it can probably be carried on, without pain, by the most trifling pressure.

As regards medicines, the administration of copaiba or cubebs in some form appears well adapted to this stage.

As stated by Ricord, both copaiba and cubebs seem to undergo some changes in the digestive process which are essential to the development of their curative properties, for injections of these agents are comparatively useless.

It is in the elimination of these agents by the renal organs that they are brought in contact with the urethra and effect a cure. This was proved by a case in Ricord's practice. A man, the subject of gonorrhœa, had a fistulous opening in front of the scrotum, communicating with the urethra, through which his urine passed. He could, however, close this opening and direct the stream over it through the usual outlet. Copaiba was administered to this patient, and he was directed to pass his urine through the fistula. In the course of a few days the "running" from this part was cured, that from the anterior portion of the urethra remaining. By passing his urine through the whole canal, the anterior portion was also cured.

The writer has frequently appealed to the experience of the patients themselves as to the effect of different remedies; and the result of his inquiries and personal experience has led him to think that, upon the whole, a treatment embracing the use of anti-blennorrhagic remedies—such as copaiba and cubebs, singly or combined—will be found to yield the best results.

The beneficial effects of these remedies may have been overrated, but experience confirms their influence upon the disease.

The mistakes that are made with reference to the administration of copaiba are chiefly two—viz. the use of the remedy when it manifestly disagrees with, and is not tolerated by, the system; and its continuance beyond a certain time where no benefit has accrued from its use. If the patient's digestion be much deranged by the balsam, then copaiba may be prescribed in some other form,—in the shape of pills mixed with magnesia, or enveloped with a coating of gelatine (capsules, as they are termed). A few days will generally suffice to indicate whether the patient can take the remedy. If his system revolts against it, only disgust and injury to health can ensue from our perseverance. Cubebs will generally be found to agree and answer well in such cases. The dose of the powder is a drachm thrice daily. Another error consists in the continuance of copaiba or cubebs, without benefit, after about eight or ten days. Nothing is more certain than that none will result from their further use under such circumstances.

Sometimes a combination of cubebs and copaiba will be found to agree with and benefit the patient. The diet during this stage may be of a good plain description, without stimulants, unless specially indicated. The more the patient continues in the open air—provided this be without much walking—the better; and the daily use of a tepid or cold sponge-bath, and frictions with hair-gloves afterwards, are useful.

As the health will almost surely have been impaired by the amount of discharge, loss of exercise, &c., it is almost essential that some preparations of steel be administered towards the close of the case. Such can be combined with cubebs, or given separately. The writer finds a combination of strychnia and iron to be an admirable one. It creates appetite, improves the digestion, and tends to keep the bowels regular, rather than confined.

Certain obstacles to success will be met with in different cases. These may be classed under two heads:—1st, local causes. Sometimes the use of injections appears injurious. The patient suffers from pain along the urethra, irritability of the bladder, and sense of weight in the perineum. Injections must then be discontinued; an alkaline diuretic, with hyoscyamus, and an occasional warm bath, being substituted for them. After waiting for a short time, other attempts may be made with injections of a weaker kind; and here the use of bismuth is indicated. Sometimes the use of injections in any form is injurious. The irritation caused by frequently inserting an instrument within the meatus; the contact of an astringent with the mucous membrane; and the direction of the patient's attention to his disease,—all tend to protract the disorder or exaggerate the importance of otherwise trivial symptoms. The presence of stricture, or obstruction of any kind, must be determined and overcome by appropriate treatment. Sometimes the discharge is kept up by a congested state of the prostatic part of the urethra and a blennorrhagia of that and neighbouring glands. The treatment will best consist of—Canadian turpentine in ten-grain doses two or three times daily; the passage of a metallic sound greased with a little oxide-of-zinc ointment (one dr. to one oz. of lard); and the administration of strychnia and iron. In some cases, where the antiphlogistic treatment and regimen have been carefully attended to, the inflammatory symptoms are of unusual duration, and appear to be unaffected by remedies. This is particularly observed in clear-complexioned persons, or those of sanguine or lymphatic temperaments. In such cases we must adopt an expectant plan of treatment: We may give pil. saponis c. opio night and morning; iodide of iron with sarsaparilla; endeavour to establish a copious diuresis by making the patient drink a tumbler of cold water three to five times daily; use injec-

tions of opium or belladonna in glycerine; and let the patient enjoy as much sunshine and fresh air as practicable.

The obstacles to success arising from constitutional causes are debilitated states of system, engendered by the disease itself, too much medication, low living, and absence of air and exercise; as well as those congenital or acquired states of system which place the patient in the same category.

Too much importance cannot well be given to our efforts for raising the standard of health by every means in our power. How often it happens that a patient's recovery is protracted from over-medication in every way! Change of air and scene; sea-bathing; a tonic regimen (including a glass or two of good port, madeira, or claret); tonic medicines, particularly preparations of iron,—alike establish the general health and cure the local disease.

Blisters have been highly recommended by many, particularly Mr. Milton; but the writer's experience has not led him to form a high opinion of their efficacy. One caution is worthy of remark, on account of the frequency with which the inquiry is made,—smoking is injurious. The writer instituted a few comparative observations upon this subject, and he found, and the patients themselves found, that smoking affected the disease injuriously.

Fourth stage—gleet. We must remember that this condition is very apt to be due to errors of constitution, such as the strumous, rheumatic, or gouty diathesis, and modify our treatment accordingly. The remarks made in regard to the constitutional remedies in the third stage will apply, with more force perhaps, to this. The further use of anti-blennorrhagics is needless and hurtful; while the administration of salts of iron is generally indicated. A combination of the tinct. ferri muriatis with tinct. lyttæ is very good. A return to accustomed exercise in the open air is to be made. So that the patient avoids fatigue and riding, he cannot be too much out of doors. Sea-bathing is generally beneficial. We must endeavour to discover what requires amendment or improvement in the system, and act accordingly. Each case will present a physiognomy of its own. It is necessary to bear in mind the tendency which exists to a return of inflammation, or an implication of other organs, as the bladder, upon the action of exciting causes.

Among the local agents which may be employed with benefit, two are of especial value—viz. the occasional introduction of a bougie, and injections, of which the sulphate, acetate, or chloride of zinc are the best. The writer thinks also that in this stage the application of a small blister to the perineum is a useful measure, particularly if the blistered surface be kept open by the use of an irritating ointment.

GONORRHOEA IN THE FEMALE.

Gonorrhœa is a much less common affection in women than in men; and when it does occur, the disease is ordinarily much less severe, and hence more rarely comes under treatment.

A consideration of the very different parts and structures, and the different physiological functions of the female generative organs compared with those of the male, will at once suggest differences in the course and symptoms of this disease in the female. While the urethral mucous membrane is the ordinary seat of gonorrhœa in the male sex, the vagina and vulva are commonly affected in the female. In the male again, gonorrhœa is the result generally of contagion; in the female, vaginal and uterine inflammation and discharges are very common from other causes, and it is impossible to say how many cases in them are the result of contagion, or to

diagnose between a discharge the product of gonorrhœal inflammation and one from other causes. Dr. West says, "The microscope fails to furnish us with a means of distinguishing between gonorrhœal and simple vaginitis, and no symptom or combination of symptoms is absolutely conclusive on this point." It is imperative upon us to remember, that vaginitis with purulent discharges is common enough in children and young females, from various constitutional and local causes, because such symptoms often give rise to perfectly unfounded charges.

Gonorrhœa in the female comprehends varieties, as it is seated in the vagina, vulva, urethra, or uterus.

In the vagina it commences as an inflammation of the mucous membrane, with heat, redness, swelling, and tenderness; and is attended with a secretion at first of muco-pus, afterwards of true pus. Any part of the canal may be affected, particularly the anterior wall beneath the pubal arch; or the whole lining membrane may be involved.

In the vulva the earliest symptoms are, sensations of heat and pruritus; to this a dry and swollen state of the mucous membrane of the vulva and nymphæ succeeds. This stage is very short, and a copious, purulent, offensive secretion appears. The tumefied state of the parts renders their separation very painful. The various muciparous and sebaceous follicles of the vulva become involved, and pour out a copious secretion. The vulvo-vaginal glands, known as Duverney's or Cowper's glands, situated upon either side of the entrance to the vagina, become engaged, and besides the copious secretion these may yield, they may become the seat of abscess. Mr. Salmon has called attention to cases in which these glands are alone affected. The swollen nymphæ often protrude beyond the labia.

The uterine form is commonly the result of the spreading of the inflammation from the vagina. The canal of the cervix is the part usually affected. The os uteri is red and patulous, hot and tender. By pressure a very tenacious muco-purulent discharge exudes. Erosions and patches of excoriation are commonly present about the os and outer aspect of the cervix.

Gonorrhœa of the urethra very rarely exists alone, but is found in common with one or other of the foregoing affections. The meatus is congested, and the canal swollen and tender; some discharge may be made to exude by pressure applied to the under surface of the urethra against the os pubis, provided the patient has not passed urine shortly beforehand. Scalding is commonly present.

The symptoms are less acute than in the male, owing to the shortness and want of complexity of the female urethra; the disease also is less protracted, and does not ordinarily pass into gleet.

Complications. Inflammation of the inguinal glands from gonorrhœa in the female is rare, and almost limited to cases in which the urethra is affected.

Vegetations and mucous patches are not at all uncommon.

Sometimes it has happened that a vaginitis has induced inflammation in the Fallopian tubes as well as in the cavity of the uterus. West mentions two successive attacks of vaginitis at an interval of eighteen months in the same patient, which were followed by such severe peritonitis as to call on each occasion for the abstraction of blood.

Abscess of the labia. The most frequent seat of this is in the neighbourhood of one of the vulvo-vaginal glands, which becomes inflamed, or its duct is obstructed, and an abscess results. A phlegmonous tumour at first appears on the inside of one or other labium, and this quickly goes on to suppuration.

Ovarian inflammation, corresponding to the epididymitis of the male, occasionally occurs. It has been described by Hunter, Dr. Tilt, and others. It is marked by pain, swelling, heat, and tenderness on pressure in one or other of the iliac fossæ. There is generally pyrexia; sometimes much nausea; and movements of the abdominal muscles are painful. The treatment of this complication will consist in rest in the horizontal posture; the application of leeches to the tender part, followed by fomentations, and the exhibition of saline medicines, with opiates to relieve the pain.

Gonorrhœal rheumatism is rarely, if ever, met with in females; and gonorrhœal ophthalmia appears to be uncommon also.

The treatment will vary, to a certain extent, according to the age and character of the patient, the sthenic or other type of the symptoms, and the stage.

In the acute stage perfect rest, salines, low diet, emollient sedative solutions, and strict attention to cleanliness, are required. Leeches are not advisable, as the bites are apt to be inoculated by contact with the discharges—inflammation and troublesome sores sometimes ensuing. As the disease subsides, astringent injections must be used; a weak solution of acetate of lead, or the liquor aluminis compositus largely diluted with water. Sometimes a weak solution of nitrate of silver is very beneficial. These injections should be used four or five times daily, in large quantities, and properly applied by means of one of Kennedy's elastic bottles. Pieces of lint steeped in the lotion should also be inserted, so as to prevent contact and friction of the apposed surfaces. The exhibition of specifics (copaiba and cubebs) in the gonorrhœa of women is perfectly futile, unless the urethra be affected, and even then they seem to be productive of little, if any, benefit.

HENRY LEE.

JEFFERY A. MARSTON.

DISEASES OF THE BREAST.

THE Surgeon who desires to discriminate accurately between the different diseases of the breast, and wishes to assist the efforts of nature in their cure, must never be unmindful of the physiological peculiarities of that organ, and the important function which it performs in the animal economy. Closely united, through the medium of the nervous system, with the pelvic procreative organs, the breasts are intimately associated with them in the performance of their healthy functions, and are not less peculiarly sensitive to, and speedily influenced by, their morbid actions.

Hence it is necessary to preface this essay with a few general remarks: 1st, on the anatomy of the gland at different periods of life, and under precise physiological conditions; for the brevity of which the required limitation as regards space must be pleaded as an excuse: 2dly, we shall refer to some of the more important points in relation to the diagnosis of the diseases: and lastly, to their treatment.

GENERAL OBSERVATIONS.

Anatomy. Unlike most organs of the body, this gland maintains a perfectly rudimentary state for several years after birth, until, like the others belonging to the functions of procreation, its development advances sympathetically and synchronously with the ovaries and uterus, at a certain definite climacteric, termed the age of puberty. Even in both the sexes changes in this organ then take place. In the male, after slight temporary excitement, the action subsides, and a state of repose is maintained by it throughout the remainder of life. But in the female the rudimentary organ of the infant and of the child becomes developed into a gland at puberty, although a state of passive maturity only is attained. Still further changes are excited by the stimulus of conception, which convert it into the source of nourishment for the offspring; when, in this its most perfect state, it becomes an active organ, a secreting gland. Yet this is but a transient condition. For in the healthy state of the organ, it continues only as long as the stimulus to the activity of its function is applied; it immediately ceases when that is removed. It now resumes a state of repose, to be, never-

theless, excited to a repetition of its function as the stimulus arises. When, however, the demand for its functional activity is withheld, or the period of life is reached when the procreative organs become dormant, this gland also becomes wasted, and the process expressed by the term 'involution' takes place, or, in other words, atrophy occurs. It must be likewise remembered, that at every catamenial period more or less temporary sympathetic excitement is apparent in this organ.

In the human subject the normal number of the breasts is two. Deviations from this very rarely occur, but one or both may be absent (*amazia*); and cases of plurality, or excess of the usual number (*pleiomazia*), are recorded. The breasts are placed on the antero-lateral regions of the thorax, and occupy more or less superficial extent in different individuals. Hence they are termed pectoral. They are interposed between the integument with the subcutaneous fat and the great pectoral muscles, beneath the inferior and axillary border of which a portion of the glandular tissue often extends. They are held in their position by fibrous bands, which extend from the integuments to the fascia of the pectoral muscle, between the separate masses of glandular tissue; these are the suspensory ligaments of Sir A. Cooper.

Examples are recorded in which glands secreting milk have existed, supplementary to the normal breasts, on the thorax, in the axilla, on the back, the abdomen, and in the groin. The form of the breast varies considerably at different ages, under its changeable functional states, and in different individuals, in relation to their peculiarities of nutrition. Considered as a mass of glandular tissue, the shape of the whole body is hemispherical, the convex surface being in immediate connexion with the integuments. The whole organ is constituted of a variable number of individual masses, each one having its separate excretory duct or lactiferous tube. These are again and again divisible into the lobes and the terminal lobules, in which are observed the acini, composed of the cæcal terminations of the ducts. The lactiferous tubes commence in these cæci, and the minute ducts unite and unite until a single canal is formed, which, after dilating before it reaches the nipple (the reservoir of Sir A. Cooper, or sinus lacteus), terminates in an open mouth thereupon. Every acinus, lobule, and separate lobe possesses a delicate fibrous envelope, and all are united together by means of the ordinary connective tissue which abounds in this organ. That segment of the breast nearest to the axillary and abdominal regions of the body is the largest. The fossa or sinus between the breasts is called the bosom. The *nipple* is that division of the gland to which all the ducts converge, which projects upon its surface, and is surrounded by a dark circle of skin called the *areola*. It is composed of a large quantity of contractile fibre-tissue, as well as connective, through which the milk-tubes pass to terminate in open mouths upon its apex, between the superficial rugæ of its integuments. Beneath the skin of the areola numerous sebaceous glands are usually distinctly visible, but not constantly.

The mammary organ undergoes great changes at different periods of life. In infancy it is but rudimentary, and although it enlarges and even secretes milk a few days after birth, it is not until the age of puberty that the glandular tissue is really developed in any quantity. At this time remarkable struc-

tural changes occur, and in a few months the growth of the organ is complete. But even then it is only perfect to a certain point. After puberty we therefore recognise two conditions: a state of inactivity or repose, passive maturity; and a condition in which the function of the gland is actively performed, when milk is secreted. At a subsequent period the tissue of the gland generally becomes atrophied, and fat occupies the place of the gland-tissue. The ducts, however, are persistent. Associated with these different states there are certain diseases requiring to be specially noticed. It therefore behoves the Surgeon to take cognisance of them in all cases of disease, the nature of which he may be required to discover.

Whilst investigating the development and structure of the breast, it is essential to bear in mind the two parts into which every secreting gland is divisible; that is to say, those structures within which the secretion is formed, and the tubes along which it flows away; or, in other words, the secreting portion of the organ, and the excretory ducts. The progressive development of this gland takes place very slowly, and is intimately associated with certain definite periods in the life of the female. We shall therefore describe its condition at birth and before puberty; at puberty and subsequent to that period; after uterine conception, parturition, and during lactation.*

1. *Anatomy and diseases of the rudimentary organ at birth and before puberty.* Before birth, soon afterwards, and to the age of pubescence, the glandular element consists of the excretory ducts only, in a more or less rudimentary state, imbedded in a fibrous stroma. In their earliest condition they are not even tubular, but solid, and are composed of an aggregation of nucleated cells terminating in clavate ends. Each duct radiates from the nipple towards the periphery, by gemmation becomes more and more branched, and, by slow degrees, a tube. Before birth the nipple is represented by a slight depression. Here we may observe that in many of the *adenoid growths*, to be hereafter described, the structures resembling those above mentioned are seen, and they are probably identical. Also that this rudimentary state of the nipple sometimes remains persistent throughout life. Soon after birth, in both sexes, the rudimentary organ becomes swollen and tender, at which time a little secretion sometimes escapes from the nipple, which, of course, is extremely minute. A well-marked hardness may be felt, which, when pressed, causes pain. By the officious interference of nurses, this excited organ is often inflamed when they use rough and frequent frictions to "rub away the milk." If this rudimentary organ be examined after death at this moment, it shows remarkable vascular congestion.†

2. *At puberty*, and especially after the appearance of the catamenia, the secreting portion of the organ becomes developed. This consists of the cæci or true terminal gland-vesicles, which are first perfected at the borders of the gland only, causing when touched a sensation as of minute granules subcutaneously seated. These terminal vesicles are formed of a structureless membrane. They are connected with the terminal branches of the ducts, and are externally covered by a network of capillaries. Their contents are oval and flattened nucleated cells. The breast having reached a state of passive

* The reader, desirous to peruse a more detailed and minute description of the physiological anatomy of the breast-gland than the writer is permitted to introduce into this essay on its diseases, may refer to *The Anatomy of the Breast*, by Sir Astley Cooper, 1840; *Ueber d. Bau u. d. Entwicklung d. Milchdrüse bei beiden Geschlechtern*, von Dr. Carl Langer, Wien, 1851; *Mikroskopische Anat. oder Gewebelehre d. Menschen*, von Dr. A. Kölliker, b. ii. p. 467, 1854; or the translation of Kölliker's *Manual of Histology*, published by the Sydenham Society, vol. ii. p. 272. Also an article entitled "Pathologische Anat. d. Brustdrüse," von Dr. H. Meckel, in the *Illustrirte Med. Zeitung*, von G. Rübner, b. i. 1852, p. 141.

† On the secretion of milk in new-born infants, see an interesting paper by Natalis Guillot, read before the Academy of Sciences in Paris in October 1853; or a translation in *Edinb. Monthly Jour. of Med. Science*, February 1854.

maturity does not appear to be divided into individual masses, and the surface of its section is therefore perfectly smooth, homogeneous, and of an opaque yellowish white tint. But a gland by which milk has been once secreted shows the separate masses of which it is composed much more distinctly, as the connective tissue unites them together less firmly. The ducts in the peripheral portions of the gland are always in a more advanced state of development than those in the centre, in the virgin as well as in the puerpera. The stroma of the breast consists of fibre-tissue in large proportions. It is chiefly filamentous and wavy; but intermixed with it is that variety so abundantly met with in the contractile membranes. Doubtless this tissue preserves the form of the organ, as well as assists in compression of the milk-tubes. Besides these tissues we see a well-defined fascia or membrane investing the most minute divisions of the gland-structure, its lobules and lobes. A double outline is thus produced bounding the cæci.

In the adenoid growths developed in the breasts of girls and young maidens, we meet with structures identical with those above described. Many of those tumours are, indeed, absolutely extra growths of the tissues composing the breast, and in some instances of even single and married women, the new growth attains to the perfection of the normal gland and secretes milk.*

At puberty the development of the breast advances more rapidly in girls than in boys. In males it is often attended with pain, which lasts but a few days, and then subsides. Occasionally, however, the region becomes much swelled, the integuments around the areola pink or red, with a conical prominence of the nipple and enlargement of the areolar sebaceous glands. When this excited action has somewhat subsided, a little serous discharge sometimes oozes out of the ducts on the nipple. Usually youths take little notice of these changes; but now and then, either from alarm at the occurrence, or from pain attending the pressure of the dress or of manipulation of the part, the advice of the Surgeon is asked. The age of the patient in whom the complaint occurs is the best aid in diagnosis. The removal of every cause of irritation, the application of moisture, if the part be red, enjoining repose, and attention to the general health, suffice to remedy the trouble. Should abscess occur, it must be treated *secundum artem*. Permanent enlargement of this gland is sometimes met with in delicate men, either on one or both sides. It is termed *gynæcomazia*.

In the female the progressive development of the gland generally advances in both breasts simultaneously, and unattended by local or constitutional disturbance. On the other hand, some girls show the anomaly of unsymmetrical development, that is, one breast enlarges and reaches a considerable size before the other makes any advance towards development. The age at which this strange defect takes place, concomitant with other phenomena of girlhood life, should guide the Surgeon to a correct diagnosis of its nature. After reassuring the patient and her friends, the rest may be left to nature. Usually the commencement of mammary development precedes the first catamenial period; and if the breasts should sympathise with any morbid state of the ovarian functions, suitable medical treatment is indicated. It is a matter of considerable importance that, in order to favour the healthy development of the breast, the pressure of the dress against the growing organ should be studiously avoided.

The nipple and areola. The nipple is composed of the ducts united together by connective tissue, with blood-vessels, lymphatics, and nerves. These are all covered by skin, upon the surface of which, and beneath the cuticle, lies a layer of pigment-cells. To this the colour of the organ, as well as that of the areola, is due. The shade of brown varies from a light to a darker hue, according to the complexion of the individual and the active or passive state of the gland itself. The connective tissue contains a large quantity of

* See cases in *Guy's Hospital Reports*, 1855, Adenocèle, case 1, with a lithograph, and case 2. Since the publication of those cases, the writer has met with others.

the contractile fibre, which when excited to contract by any local irritation, or even mental emotion, produces a rigidity of the whole organ, which has been termed erection. There is not, however, a trace of true erectile tissue to be seen in it; the capillary blood-vessels are numerous and looped, and they may become congested; the milk-tubes may likewise be turgid and distended, as occurs during lactation; but the prominence and rigidity of the nipple, occurring in the virgin or married woman, is really only attributable to the existence of the contractile tissue, a layer of which exists also beneath the cutis of the nipple and areola, and produces the peculiar corrugation of that dark circle of integument. If carefully examined, it will be seen that the *cutis anserina* of the surrounding integument usually accompanies the condition of the nipple above alluded to. Covered by the skin of the areola are the lacteal sinuses. Here the ducts dilate before entering the nipple. Within that organ they are again contracted, and where they traverse the cutis each tube is extremely fine. Their open mouths are protected between the rugæ of the cutis; for the terminal boundary of the nipple is somewhat flattened and rugous. In these furrows small ulcers are frequently formed, and the secretions of the minute follicular glands and of the ducts, when allowed to accumulate, cause considerable irritation and inconvenience. The contractile fibres in the apex of the nipple may subserve the important purpose of preventing the constant flow and escape of the milk from the ducts. The validity of this statement can be tested by examining the nipple when its ducts are distended and the outlines visible near its root or beneath the areola. But as soon as the warmth of the infant's mouth induces a relaxed state of these fibres, the mouths of the ducts are no longer compressed, and the milk flows freely.

The glands of the areola. Within the area of the areola are situated hair-follicles and sebaceous glands; the latter are often arranged with considerable regularity, especially a circle of them, smaller than the others, near its periphery. The large sebaceous glands elevate the delicate cutis of the areola, beneath which there is always an absence of fat. Hence sebaceous tumours are occasionally developed in this region. Hairs are rarely developed, except as age advances, or as correlative with a somewhat masculine development, or tendency to hairiness generally.

The nipple also becomes somewhat further developed at puberty in the female. It forms with the areola a conical elevation of the skin, having a bluish or pinkish tint; but it does not project much until a later period of life, often never at all in unmarried women. The size of this organ varies exceedingly in prolific women as well as in sterile; for, even in those who have suckled large families, its size often bears no proportion to the use made of it. In shape, too, it is very variable. Sometimes it is bifid at the extremity, and even two nipples have been seen on one breast. Anomalies in number and position occur in both sexes. But the most perplexing deformities affecting this organ are those where the development of its projection is arrested and it continues flat; or when, worse still, a depression or hollow only exists, in which the milk-tubes terminate. Very rarely a duct opens on the areola, not as the result of disease, which occasionally happens (fistula), but as a congenital imperfection.

Cases of precocious development of the breasts are recorded.*

3. *After the complete establishment of puberty; after uterine conception; after parturition, and during lactation.* The only normal changes in the female breast which occur irrespective of conception are slight enlargement, attended with more or less pain, according to the susceptibilities of individuals, at each catamenial period, and a slight change in form and consistence soon after congression with the other sex. The nipple, areola, and its glands, show great changes, as respects form and colour, under these circumstances, as well as

* *London Journal of Medicine*, vol. i. p. 85; *Gaz. Méd. de Paris*, 1834, p. 881.

after uterine conception; but it would be foreign to our purpose to dilate upon them.

The changes of most importance affecting this organ are excited by conception. Now it is that its peculiar function to secrete food for the nourishment of the offspring is about to be performed; and from month to month, simultaneously with the development of the fœtus, alterations in the condition of the breast are observable. These changes are most easily watched in women having small glands; for in such the secreting portion of the organ would seem to disappear almost entirely after the cessation of lactation; whilst in those whose breasts remain permanently large throughout life the structural changes are not so easily detected. Nor does the size of the organ bear any just proportion to the perfect performance of its function; for, as a rule, large breasts do not secrete so freely as small ones; and generally, when the milk is abundant, it is very poor in its nutritious qualities. Neither are its dimensions always in relation to the constitutional nutrition of the woman. For we often see strumous, cachectic girls with largely-developed mammæ, whilst healthy, well-nourished maidens offer the opposite condition. It is probable that sexual impulse determines, to a certain extent, the growth of these organs. And further, it should be recollected that bulkiness is not always due to excess of gland-tissue, but to a growth of fat.

Where the gland-tissue has arrived at the *stage of passive maturity*, after puberty, the secreting portion of the organ can be very clearly seen in consequence of the cæcal terminations of the ducts containing more or less epithelium. In addition to the gland-tissue, there is usually some fat diffused throughout the stroma in small lobules. The adipose tissue is more abundantly developed around the borders of the whole gland and upon its anterior surface; but it is rarely found between it and the pectoral muscle. As years pass on, however, when the breast has never been excited to the performance of its peculiar function, the cæcal terminations of the ducts are with difficulty detected, and the entire mass of the organ seems to be composed of fibre-tissue, fat, and ducts only. But at any moment the induction of excitement, reflected from the pelvic generative organs, may give rise to a certain amount of activity in the cæcal ends of the ducts, which become congested with epithelium, and thereby is produced more or less general enlargement and induration of the whole breast. When, as commonly happens, the stimulus excites a single mass or a lobe, or even separate lobules, the swelling and irregularity to the touch produced thereby, causes misapprehension that a new growth is developed. Such, however, is not a fact. We have to deal in such cases with a morbid state of the true gland-tissue, not with something superadded to the normal organ. A distinction not without a difference, for it is based upon structural peculiarities, and is of paramount importance as regards the treatment of the case.

After uterine conception the breast becomes at first full and firm, when small granular bodies may be felt around its periphery and upon its cutaneous surface. If a section of it be made in about the third or fourth month of pregnancy, the tint of its tissues is pale red and the surface irregular, especially at the periphery; it is no longer a uniform white, opaque, homogeneous mass; although in its centre the changes are only just perceptible in comparison with those at the periphery. The vascularity of the organ is also one of its marked features, for minute blood-vessels are visible ramifying in its tissues. In the passive organ scarcely a vessel is noticeable. If one of the minute granular bodies (a gland acinus) be removed, and its tissues carefully separated with needles, the cæcal terminations of the ducts are distinctly seen by the aid of a microscope. The addition of a drop of dilute acetic acid favours the observation of this object. The limiting membrane, or tunica propria, of the terminal gland-vesicles or cæci encloses more or less epithelium, the separate elements of which are oval and nucleated. In the centre of the breast the stroma shows a curious reticulated structure, in the meshes of which the writer is inclined to believe the acini are subsequently deve-

loped. At a later period of uterine conception the cæci are in greater abundance, and contain colostrum-corpuscles in addition to the epithelium.

After parturition and during lactation the surface of a section of the breast is deeply divided into lobes and lobules, and the acini are very distinct. It closely resembles the cut surface of a parotid gland or a pancreas. The cæci are filled with epithelium, which also contain the cells bearing the fatty globules found in milk. The breast has now attained its state of active perfection.

Such is a brief description of the metamorphosis of the inactive organ into an active secreting gland. In the perfection or imperfection of the changes taking place in the secreting portion of the glandular tissue we may seek an explanation of those cases, rare though they be, in which no sympathy seems to exist between the breast and the gravid uterus, and of others in which milk is never formed. In the first defect, when there is not any change during pregnancy, the caecal terminations of the ducts are not developed, therefore the cells cannot be generated in which the fatty particles of milk are formed; and in the second, although the gland-vesicles may be complete, yet the epithelium is not perfected, and the milk-globules are absent.

Innervation. The following scheme demonstrates the distribution of the spinal nerve-filaments to the skin over the breast, to the gland itself, and their associations with the cutaneous filaments of the contiguous regions.

Cervical plexus					
Posterior filaments of 4, 5, 6 unite with posterior branches of superior dorsal.			Anterior branches of 4, 5, 6 (?) supply skin over breast and unite with		
Dorsal plexus	Middle intercostal nerves	2. Also, skin inside of arm and axilla.	Breast and skin over it.	Anterior intercostal nerves	Dorsal plexus
		3. Also, skin of acromion, axilla, and arm.			
		4. Also, skin over scapula.			
		5. Same.			

It should be thus read. The breast and the skin covering it are supplied by filaments from the anterior branches of the 4th and 5th cervical nerves. Filaments from the posterior branches of the same nerves join with others from the superior dorsal nerves. Filaments from the middle and anterior intercostal branches of the anterior division of the 2d, 3d, 4th, and 5th nerves of the dorsal plexus supply the breast and skin over it chiefly. A minute examination demonstrates the association between the 2d intercostal and filaments supplying the skin of the inside of the arm and axilla; also the same parts and the skin about the shoulder from the 3d; and the skin about the scapula from the 4th and 5th. These nervous intercommunications explain the widely extended pain of which patients so grievously complain when affected with mammary hyperæsthesia.

The arteries and veins. The 2d, 3d, 4th, and 5th intercostal branches of the internal mammary artery usually convey blood to the sternal segment of the breast; within the axillary portion a large branch from the artery of that name very commonly ramifies; and the inferior and lateral regions receive a few branches from the intercostal vessels, which pass with the nerves through the middle intercostal foramina. As the nerve-filaments accompany the ar-

teries, it is necessary to be careful to avoid embracing them in the ligatures used to arrest bleeding.

The veins usually accompany the arteries, and terminate in the internal mammary and axillary trunks. A peculiar arrangement of the subcutaneous veins around the areola has received the name of *circulus venosus areolæ* (Halleri). The superficial veins are often dilated in those cases in which tumours are developed in the breast. This morbid condition seems to arise partly from their pressure, the interruption to the flow of blood, and probably to the increased quantity circulating through the growth.

The superficial lymphatic vessels terminate in the axillary, the cervical, and anterior mediastinal glands; a deeper series pass over and beneath the pectoralis major muscle to the glands placed under the clavicle.

General observations relating to the diagnostication of the diseases of the breast. The diagnostication of the diseases of the breast is considerably assisted by ascertaining the age of the patient at the time of the development of the growth and its relation to the state of passive maturity or functional activity of the gland. The Surgeon should ascertain the social position of the patient and her temperament; observe the condition of her nutrition, and especially whether, in relation to her actual age, she shows a youthful or aged aspect. The functional powers and derangements of the pelvic generative organs must be ascertained with precision, and in relation with them the state of the breast should be compared, as well as that of one breast with the other. Discharges from the nipple, its ordinary development, and any deviations from a normal condition, are important subjects, and should elicit inquiry relating to congenital or acquired defects. Uneasiness; temporary, transient, or persistent pain should be traced in certain defined directions with anatomical precision; and the intimate association between the nerves of the gland and the neighbouring plexuses cannot be too carefully remembered. The lymphatic vessels and the glands in the axilla should never be overlooked; and even a wider range of observation, comprehending those above the clavicle and in the anterior mediastinum, must be taken. Having carefully obtained a knowledge of the facts above alluded to, the Surgeon has then to determine whether the disease under observation involves the normal tissues composing the organ, or whether there be a new growth.

The age of the patient should be carefully ascertained, with the view to discover the period of life at which the disease was first observed; *e.g.* by deducting the age of a new growth from the actual age of the patient at the moment of observation. That inquiry enables the Surgeon to determine whether the existing affection is associated with the development of the gland; its state of maturity; or a condition of repose and atrophy. Also, the actual age being known, the Surgeon is enabled to decide whether the patient shows signs of premature age, a fact often of great moment in deciding on cases of carcinoma.

The social relations of the patient, whether living a life of celibacy or the

contrary; if married, whether prolific or sterile; and if prolific, whether the organ has performed its functions in a healthy manner or not, are facts to be noted, several of its morbid states being closely connected with the secondary influence of social conditions, as the indurations of the gland-tissue in unmarried women, or in others who, although married, are yet sterile. Again, the activity of this organ, sympathising as it does with the functional changes occurring in the uterus, is excited to increase of growth in preparation for the performance of its functions; and such normal increase in bulk might be mistaken for a morbid process, unless the actual social relations of the individual be conclusively established. Nor should the habits, occupation, and possible moral depravity of the sufferer be wholly neglected; for indulgence in vicious propensities doubtless exerts a secondary influence on the mammary organ: such as illicit intercourse with the male sex, intemperance, indulgence in spirituous liquors, unnatural sexual excitement, and constitutional syphilis. A strange perversion of the moral feelings occasionally exists which incites to the production of factitious disease in this part.

Observing the temperament of the patient sometimes assists in distinguishing the nature of the morbid affection: *e.g.*, in girls of an excitable nervous disposition, the gland is frequently exquisitely sensitive without being absolutely diseased, and some even describe an intensity of suffering and misery wholly incompatible with tangible local symptoms. A state of hyperæsthesia exists, purely, free from organic morbid processes.

The healthy nutrition and youthful aspect of one sufferer, as well as the cachectic care-worn look of another, both perhaps of the same age, are useful facts to aid diagnosis, although they must not be allowed paramount influence in every case. Thus, in a girlish, healthy-looking woman, a growth in the breast, however large, may be pronounced innocent, almost with certainty; whilst in another the anxious mien and aged facial aspect, the result of constitutional dyscrasia, may excite the suspicion of carcinoma. Caution must always be exercised in those instances in which the local disease, although physiologically innocuous to the constitution, may have excited much mental distress and bodily suffering in consequence of its condition during progressive stages of growth.

An inquiry into the state of the functional products of the generative organs should never be neglected, especially as regards the catamenia. The opposite conditions of excess and deficiency of the menstrual flux incite to sympathetic processes in the breast, and a certain class of its diseases are probably dependent entirely thereon.

When any disease occurs in the breast of a child-bearing woman, the capability of its functional powers should be ascertained; and if from any decided cause its secretion happens to have been interrupted or arrested, an attempt should be made to associate the existing disease with the active state of the gland. It frequently happens in such cases, whether associated with deformed nipple or not, that disease appears even many months after lactation has ceased, generally assuming the form of chronic abscess. This affection, however, is most common when the nipple has not been perfectly developed. In an imperfect state of the nipple, we have a fruitful source of trouble, and the natural conformation of the body of the organ, as well as of the nipple, prior to the discovery of any disease, should be carefully ascertained in every case specially under observation.

A knowledge of the manner in which lactation may have been performed by the two glands comparatively; the number of times that function has been excited and its duration, together with the diseases occurring during those periods, often aids the diagnostication of a disease existing a considerable period of time after the cessation of suckling, and which may be even intimately connected with some irregularity occurring at that time.

Without putting a leading question, the Surgeon should ask the patient to describe the sensation or pain felt in the part; but, he must be somewhat on his guard against implicitly accepting her statement. If the

sufferer has read upon the subject of cancer, and believes herself to be affected therewith, she will certainly state that the pain is "lancinating, darting, stabbing," and so on, and again the intensity of the pain is sometimes exaggerated. But there is pain which happens to be so characteristic of the class of diseases it accompanies, that its nature and the method of inducing it become pathognomonic of the special affection. The anatomist will remember that the integuments over the mamma, as well as the organ itself, receive their nervous filaments from the 2d, 3d, 4th, and 5th nerves of the dorsal plexus; that those branches, called intercostal, divide into middle and anterior cutaneous filaments, which are the nerves of this gland, and that they reach the skin by passing through openings between the ribs. The wide-spread distribution of other filaments of these same dorsal nerves should also attract attention (see p. 659). Now when a patient complains of inordinate pain in the breast, with or without induration of the tissues, the acute sensitiveness of the nerves distributed to it is easily demonstrated by digital pressure over the middle or anterior intercostal foramina, whence they emerge upon the chest. In severe cases of this neuralgic affection gentle pressure is intolerable, and the pain extends far and wide over the back, neck, and arm. Even the nerve supplying the particular lobe which is indurated is sometimes alone affected, whilst in actual new growths this is not commonly the case. Thus local pain and pain widely distributed, as well as pain excited by the application of digital pressure with anatomical precision, becomes an important aid in the diagnosis of some of those affections of the breast which excite the greatest alarm in the mind of the patient, although happily they prove to be harmless, in spite of the difficulty sometimes experienced in affording speedy relief.

In every case immediately under observation the Surgeon should first attempt to ascertain definitively whether the disease affects the normal tissues of the organ, or whether there be something superadded to them; in fact, a new formation or growth. A tumour, swelling, or enlargement may be felt, and still there may not be any thing in addition to the normal structure; *e.g.* a single lobe of an inactive gland may be enlarged and cause a suspicion that a new growth exists; but if it be cut out and examined, only gland-tissue is found gorged with epithelium. By careful and methodical manipulation, however, this morbid lobe of gland-tissue, a very common affection too, may be certainly distinguished from a new growth. In this manner examine the part. Press the induration gently between the thumb and fingers, and a tumour is so distinctly felt that the positive existence of something superadded to the breast is affirmed; but now place the fingers lightly and flatly upon the part over the site of the supposed new growth, pressing gently against the thorax, and nothing more than the ordinary gland-tissue is perceptible. On the contrary, if there be a genuine new growth, something developed recently within the normal gland, it will be always felt, in whatever manner or in whatever position the patient is examined.

Condition of the nipple, and of discharges therefrom. The ordinary condition of the nipple preceding the observation of the disease should be always ascertained with precision. A congenital defect in its development commonly causes great trouble during suckling; is the promoter of some diseases associated with that function; and often accompanies some new growths. It may, however, become retracted when chronic inflammation, or even acute, and lactic congestion affect the organ; and therefore this state cannot be considered of real value in aiding the diagnostication of any special disease. Even when accompanying carcinoma, it merely marks a stage or particular condition of one kind of that disease. The fluids which sometimes ooze from the nipple at the commencement or during the progress of a new growth, may be rendered subservient to the formation of a correct diagnostication of the nature of the disease in the part. Sanious, offensive, opaque discharges, containing cells, identical with those forming growths of cancer, may be regarded as indicative that the induration which would probably accompany

the exudation of such fluid arises from infiltrating carcinoma; whilst a bright yellow clear tenacious serous fluid, drawing out into thread-like processes, and the flow of which is perhaps increased by compression on a circumscribed collection of fluid, would guide the Surgeon to an accurate opinion that the tumour depended upon the presence of an adenoid growth, or a simple cyst. In a similar manner some of the duct-cysts may be diagnosed from the mucoid character of the fluid escaping from the nipple.

The lymphatic glands in the axilla and in the neck just above the clavicle should be always carefully examined. Some care is here requisite to ascertain if their morbid condition, when any may happen to exist, preceded or followed the disease in the breast.

In order to insure perfect accuracy in diagnosis, especially of obscure cases, the breast should be examined whilst the patient is seated, and also when placed in a recumbent posture. The affected part may then be carefully supported upon the trunk by slightly rolling the body over on to the opposite side and placing a pillow under the shoulder.

Briefly, then, the Surgeon will be led to these inquiries:—Has the disease in question any manifest connection with the age of the patient; the stage of development of the gland; its functional activity or repose; and the social condition of the patient? Does it seem to be associated with any general disturbance of the functions of the generative organs? Is it merely a local affection, or more intimately accompanied with general constitutional dyscrasia? Is it of inflammatory origin? Is it traceable to a morbid state of the excretory ducts, or of the secreting structure of the organ? And, lastly, is the swelling, tumour, or tumefaction really caused by something growing in the breast, a new growth; infiltrating the tissues of the breast, inflammatory or otherwise; or simply a morbid condition of a part or whole of the actual tissue of the organ, an excited state of the gland-structure? In other words, is the disease *in* the breast, or is it a morbid state *of* the tissues composing the breast?

The formation of a correct diagnosis between one disease of the breast and another is infinitely facilitated by employing the method of exclusion or negation; *e.g.* suppose the patient under observation to be afflicted with a certain definite disease, and then endeavour to ascertain if the facts of the case agree with those indicative of that class. If they do not, that assumption is set aside, and another adopted and examined in a similar manner. This method, however, requires considerable experience, and is not therefore, perhaps, available for very young practitioners.

General therapia. First, in relation to the healthful development of the gland from birth to puberty; during pregnancy; and after parturition.

Soon after birth, when the integuments around the mammilla are swollen and tender, great care and attention are required on the part of the nurse, that the dress of the infant does not compress the chest, and thus irritate and injure the rudimentary organ. Should the skin around the areola become red and painful, a thin layer of cotton wool moistened in water and laid on the part, is the most suitable protection. The treatment of the diseased states is described in another place. All manipulation of the swelling is reprehensible in the highest degree.

At puberty the gland should have free scope to allow for enlargement, and pressure on the nipple ought to be carefully avoided. The ordinary tenderness experienced by delicate and excitable girls at this time, and especially at the catamenial periods, requires only repose and the withdrawal of all causes of local irritation.

During pregnancy arrangements should be made in the dress to prevent the clothes compressing the gland, or irritating and squeezing the nipple. If

that essential portion of the organ be imperfectly developed, or even inverted, as sometimes happens, and a depression instead of a projection exists, measures may be taken with the view to encourage its development. These would consist in fixing over the areola a circular piece of some thick, unirritating material with a hole in its centre. We believe that very slight advantage is gained by the application of medicated lotions to the nipple, as prophylactics against the irritation caused by suckling. As soon, however, as the colostrum is secreted and oozes from the ducts, the extremity of the nipple should be carefully cleansed with warm water, lest in drying, the mouths of the ducts should become irritated, perhaps obstructed.

After parturition the infant may be allowed to suck as soon as possible, that is, as regards the breast. Its functional activity is not, however, perfect until after the lapse of a few hours from that event. But great distension should never be permitted to occur; and when the secretion forms in such large quantity that the efforts of the infant are unequal to the prevention of this condition, some artificial means should be adopted to avert the ill results consequent upon the neglect of that state. During the earlier periods of suckling the nipple should be gently bathed with warm water when the infant desists; some protection against the friction of the dress is desirable, especially with a tendency to irritable nipples; and all nostrums, applied under the impression of "hardening the nipple," scrupulously rejected. Much vigilance is advantageously employed in seeking for "milk-knots" or "coring of the milk," as these hard lumps are commonly called. This morbid condition, being due to lobular congestion, will, unless relieved, inevitably proceed to inflammation and abscess. Gentle frictions, with olive-oil, sometimes help to disperse such swellings; but they should not be employed unless by the direction of the Surgeon. To the application of warmth and moisture we give the preference; and a careful examination of the orifices of the ducts should be instituted, in search of obstructions from accumulated secretion or epithelium. As the comfort, happiness, and well-being of the mother and infant are so inseparably blended with the healthy performance of the function of lactation, it is impossible to devote too much attention to the search after the least trace of morbid action.

At the time of weaning the breast should never be allowed to become excessively congested with milk. A very small quantity should be removed by artificial means, only just sufficient to relieve distension, never to excite a renewal of secretion. Repose must be enjoined, and an active use of the upper extremities restrained for a day or two. If any circumstance has necessitated the relinquishment of suckling for a brief period, a healthy secretion may be sometimes regained, even after the lapse of a few weeks, by letting the infant suck if it will, or by making use of a breast-pump.

Secondly, in relation to the therapeutics of diseases.

The following remarks refer chiefly to methods of treatment applicable to many different kinds of diseases. The special treatment of any one particular disease is described in that part of the essay devoted to its consideration.

Support and compression. The principle embodied in every method which has for its object the support or suspension of the gland against the chest, is, in fact, that of repose. By the methodical adjustment of a bandage to the breast, its movements are restrained, and the tissues which are progressively advancing towards a resumption of a healthy state are not liable to those injurious effects which the weight of the gland might exert on delicate, newly-formed structures. A suspensory bandage may be employed. It should be made of some soft fabric with rather open texture, in order to avoid excessive heat. It may be so shaped as to fit the organ, and retained in its position by two broad bands of calico, one passed over the opposite shoulder,

the other encircling the trunk below the breasts. An ordinary bandage or roller made of calico, soft linen, muslin, or the elastic woven fabric, about one inch and a half to two inches wide, may be adjusted in the following manner. The Surgeon, standing before or behind the patient, who should be sitting, passes an end over the opposite shoulder, as low down the back as the lumbar region. The bandage is then carried round the trunk, and the next turn taken over the shoulder, beneath or across the breast, and again around the trunk and then over the shoulder, and so on alternately, until the part is entirely enveloped. In this way, one fold overlying that below it, a very firm, uniform, and tolerable support is afforded. At certain points where the folds of the roller cross, a few stitches may be inserted with advantage. In some cases, strips of lint smeared with an ointment may be laid on the breast, and kept in that position by means of plaster. There are two ways of applying plaster; in a single circular piece, or in strips. If in one piece, a hole should be cut near its centre for the nipple to go through. Incisions should be made from the margins of the circle converging towards the centre, and terminating near the hole. When applied, the pieces slightly overlap each other, and lie flatly. Another plan consists in cutting a piece of adhesive plaster in the shape of a crescent, and fixing it to the abdominal half of the gland. A piece about two inches wide is afterwards placed on the sternal and axillary borders, somewhat obliquely, and extending towards the centre of the clavicle. A third consists in applying strips of plaster one inch and a half in breadth, one piece slightly overlying the one below it. The operator begins at the abdominal border of the gland, and covers as much of it as is needful. During all these operations with strapping, the patient should be in the recumbent posture, and the trunk slightly inclined to the opposite side, in order that the breast may rest upon the chest and not be pendent. Various substances have been used to fix the bandage securely: viz. adhesive plaster outside of it—this may be useful if the skin be irritable; starch, gum, collodion, dextrine, and even plaster of Paris; but all of these make the bandage very rigid, therefore often intolerable, and when a necessity exists for its repeated application, inadmissible. Should the nipple become ulcerated and require protection, shields are made of various materials; of metal, as lead; of vulcanite; or of something softer, as vulcanised india-rubber.

Sinuses may be injected through the fistulous openings in the skin with various stimulating injections. To do this effectually, it is well to make use of a piece of flexible catheter, which should be introduced as deeply as possible to insure the full effect of the injection. As a drain-tube, a contrivance, well suited to effect the purpose intended, consists of a piece of very thin gutta-percha, rolled up in the form of a tube, inserted to the requisite depth.

The milk may be artificially removed from the breast by means of exhausting syringes, made for that purpose; by glass tubes or bottles to which some arrangement is affixed in order that exhaustion may be effected by the mouth; or a wide-mouthed bottle may be used, which, after being filled with hot water and emptied, is applied over the nipple. As the air within cools, the mouth of the bottle must be very carefully kept in contact with the breast.

Amputation of the breast. The proceedings adopted in the removal of tumours from the breast are described in their proper places. The entire gland may be excised in this manner:—An elliptical incision is made upon either side of the nipple, the distance from which may be left to the discretion of the operator. Flaps of integument should be made of sufficient dimensions to fall together readily, without stretching them. The direction of these incisions should correspond with that of the fibres of the pectoralis major muscle. The lower or axillary flap should be made first, and the Surgeon will find the accomplishment of the operation facilitated by detaching the gland from the fascia of the pectoral muscle immediately after he has made that flap. Next, the sternal flap is to be cut from the anterior surface of the breast, and then an incision carried round the sternal border of the gland detaches it completely from the trunk. Loss of blood is, in some measure,

prevented by an assistant compressing the anterior intercostal arteries with his fingers placed over each intercostal foramen. Another should put a finger upon the mouth of any bleeding vessel, especially the branch from the axillary artery, which is often of considerable size. Bleeding arteries require ligatures, and the exercise of due care to avoid tying the collateral nerve in the knot. The integuments should be brought together, and maintained *in situ* by plaster or some other means, according to the inclination of the Surgeon. Compresses of lint should be adjusted along the edges of the wound to maintain the flaps and subjacent tissues in close apposition; but openings must be left at either extremity of the wound for the escape of discharges. If secondary hæmorrhage occurs, and the wound becomes filled with coagulum, it is advisable to remove all the dressings, clear away the coagula, tie the bleeding vessel, and rearrange the wound. Cicatrisation is greatly impeded by neglecting this procedure.

SPECIAL DISEASES. DIVISION I.

MORBID CONDITIONS OF THE TISSUES COMPOSING THE BREAST.

Hypertrophy. A breast having attained extraordinary dimensions, owing to the gradual growth of the tissues composing the glandular structure, is said to be hypertrophied. This disease is extremely rare. It is quite distinct from that functional enlargement of the organ which is associated with amenorrhœa. There are two conditions which produce a very different appearance of the whole of the affected part. In one, the breast is large, firm, resists the pressure of the finger, and projects in bold relief upon the thorax, the integuments being tense and smooth; in the other, the gland is pendulous, dangling loosely from the chest in whatever direction the trunk is inclined; it lies flat and flaccid on the hand, is weighty, tremulous, and constantly varying in shape; when pressed between the fingers, it feels as if its life was gone, were it not for its temperature and tint, since the fibre-tissue seems to possess no vital contractile force. Its shape is sometimes pyriform, the integuments are shrivelled and wrinkled, and the apex of the nipple is turned upwards towards the clavicle, instead of in its normal direction. The component masses of the gland are so loosely connected together that the fingers lie in fossæ between them, the whole contour of the organ being totally devoid of its normal and agreeable form. The nipple is generally small, sometimes quite undeveloped, and the areola is spread over a larger area than usual.

This disease commences soon after puberty, or in early adult life, in single women as well as in married. It would appear as if, the growth of the organ having been excited, this action is not controlled, and hence enormous bulk is attained. Both the breasts are affected; generally simultaneously, although, perhaps, they may not be of quite equal size. The general health and nutrition of the sufferer is sometimes good and is not at all impaired, until distress is occasioned by the incumbrance and weight of the masses. Usually the catamenial function is more or less deranged. The author has

seen the pendulous hypertrophy accompanied by a new growth, an adenocoele, which he removed, but the morbid state of the organ continued. We may distinguish between this disease of the breast and others by regarding the age at which it is developed—for it is an affection of early life; the functional state of the organ; the commencement of the disease tracing back to the development of the gland at puberty; the participation of both breasts in the morbid action at the same time—for it very rarely happens that a new growth so forms in both; the tactile indications, remembering that occasionally a new growth may be superadded; the generally, at first, unimpaired health of the patient, and the absence of local suffering. Neither constitutional nor local remedies produce any marked benefit. Should the catamenial function be morbidly affected, all due attention must be paid to the fact, and remedies likely to improve its condition may be prescribed. Amputation of the larger of the breasts has been successfully performed; but it is a measure to be had recourse to only under most adverse circumstances. Nevertheless, in some of the cases after the operation the remaining breast diminished considerably. In a case reported by M. Bouyer, both breasts were successfully removed, the patient losing by the operation one-third of the weight of her whole body before its performance. After a critical examination of several of the recorded cases of a single large breast, we may be allowed to question the correctness of applying the term hypertrophy to them, and to doubt their being really examples of this disease. Doubtless in many the dimensions of the breast were caused by the development of a new growth, as in the case published by Dr. Ashwell in 1841.*

Atrophy, or wasting of the secreting tissue of the breast, commonly takes place as life advances and the procreative functions cease. The gland is very generally replaced by fat, so that the outline and form of the organ is preserved. The ducts are always persistent, and sometimes contain a tenacious mucus.

Occasionally, in early life, the secreting tissue is so far atrophied, that even during pregnancy the ordinary changes in the organ do not take place, and after the birth of the child there is a total absence of the secretion of milk. The breast often wastes when new growths are developed therein, and even in young persons adenocoeles are sometimes seen to take the place of the normal organ. Very protracted lactation and rapid repetition of the function, in delicate women, exert a baneful influence on the fibrous structures, which interferes with the healthy form of the gland in after-life. And, in some persons, after weaning, the glandular tissue shrinks so remarkably that scarcely any breast remains; nevertheless, during a subsequent pregnancy,

* *Guy's Hospital Reports*, vol. vi. p. 203, with a plate. This proved to be a new growth, an adenocoele; and it was subsequently removed by Mr. Stanley, 1843. The tumour is preserved in the Museum of the College of Surgeons (prep. 8).

We have selected for reference the following cases recorded within the present century, and have arranged them in two groups:—1. Those in which the disease commenced at puberty. Hey, *Practical Obs. in Surgery*, 8vo, 3d edit. 1814, p. 500; Cooper, *Illustrations of Diseases of the Breast*, 4to, 1829, p. 70; Huston, *American Journal of Med. Science*, 1834, vol. xiv. p. 374; Malgaigne, *Gaz. des Hôpitaux*, 1844, 599.—2. Cases in which the disease commenced after the establishment of puberty, married women and unmarried. Delfiz, in Majendie's *Journal de Phys. Exp. et th.* 1825, t. v. p. 396; Schaal, in Rust's *Mag. f. d. gesammte Heilkunde*, 1825, xix. p. 360; Cerutti, L., Meckell's *Archiv f. Anat. u. Phys.* 1830, p. 287; Hecker, *d. Zeitung v. Verein f. Heilkunde in Preussen*, 1837; Skuhersky, Weitenweber's *Beiträge z. Med. u. Chir.* 1841, p. 42; Bouyer, *Gaz. Méd. de Paris*, 1851, 301.

the normal changes take place and the organ performs its functions in perfection. In fact, as a rule, a mother with breasts of this description generally proves a more efficient nurse than another in whom the large dimensions of the gland might be regarded as indications of its perfection.

Inflammation, and its results. The various kinds of this morbid action occur at every age and in all conditions of the organ. They rarely arise either before puberty, about that period, or during the inactive state of the gland. But, on the contrary, they are very common in the adult and during lactation. During pregnancy and when weaning, inflammation very rarely happens; but it is more common during the former period than the latter. And, when developed at weaning, it is usually excited by an accidental circumstance, *e.g.* the death of the infant, or illness of the mother necessitating the abrupt discontinuance of suckling. In numerous instances it is secondary to local irritation, especially ulceration of the nipple, obstruction of a milk-duct, or a contusion; and, as an occasional source, we must notice a diseased state of the axillary lymphatic glands. Having stated that it arises, first, in the inactive stage of the organ, and secondly, at periods of its functional activity, we may next describe its effects in relation to those different conditions.

During infancy. Soon after birth, in both sexes, although most commonly in the male, the mammilla frequently becomes swollen and painful, the skin around slightly pink, and there may be a serous fluid, or even milk, secreted, which oozes from the ducts. Nurses who indulge the propensity to interfere with the processes of nature, by "rubbing away the milk," too often excite inflammation, which is indicated by the usual local and constitutional signs, and sometimes passes on to suppuration. Even eight days after birth this rudimentary organ occasionally causes much pain from slight inflammation becoming developed around it, which cannot be assigned to manual interference. And in a female infant, three months old, we have seen an abscess in this region, the exciting cause of which it was not possible to discover, except it was constitutional delicacy. The mother of this infant stated that, unlike others, there was not in this one any secretion in the breasts after birth, and that, consequently, the usual means to "rub away the milk" were not employed. We need scarcely say that, as a prophylactic measure, every cause of irritation must be carefully removed from the excited organ; even the friction of the dress against it should be prevented in delicate infants. With a tendency to inflammation, warmth and moisture may be maintained over the affected part by using the softest application, such as moist cotton-wool, or some medicated lotion may be advantageously employed, *e.g.* liq. plumb. diacet. dilutus.

At puberty. Associated with the development of the breast in the female, inflammation very rarely occurs, although the gland often becomes exceedingly painful, and the nipple and areola of a deeper red. But after puberty, when the organ is developed but inactive, both acute and chronic inflammation arise; for which it is often difficult to assign a cause. Chronic abscess is certainly more common than acute. This disease occurs in delicate strumous girls; it usually commences as a hard, painless, defined swelling, with sometimes slight uneasiness. In this stage it may be easily mistaken for a

new growth, until, as the tumefaction enlarges, it becomes softer and softer, and fluctuation is detected. Then it is supposed to be a cyst, as very little pain has been felt, and constitutional disturbance has not been excited. At last the swelling is punctured and the pus escapes. In this way the discovery of the contents of the cyst is frequently made, and all doubt as to the nature of the complaint is removed. Cases of this kind deceive even the most experienced Surgeons. Operators, acknowledged to be the greatest adepts at diagnosis, have proceeded so far even as to commence an operation for the removal of a new growth from the breast, which proved to be but a chronic abscess; and therefore the careful Surgeon should always suspect the existence of a chronic abscess until there be most unequivocal indications that the disease is of another kind. In cases of this class the disease appears to depend chiefly upon some constitutional defect, and therefore the rule as regards treatment is to improve the general health. It would be idle to enter at great length into the treatment of this malady. Bearing in mind the anatomical disposition of the organ, and its relation to the surrounding structures, it demands no very special mode of treatment. We may therefore pass on to that kind of inflammation and abscess so commonly developed in the breast at the time it is an active secreting organ, or preparing to become one.

During pregnancy and lactation. Inflammation rarely occurs whilst the breast passes through those phases which render it a secreting organ. At this time it is often very painful, and there may be slight vascular excitement; but inflammation is not developed unless some injury chance to be inflicted by sudden violence or continued compression exerted by the clothes.

It is, however, very common during lactation. Generally it happens with primiparæ; and, in a majority of cases, it is determined by either a defective development of the nipple or a morbid state of it. It most frequently arises during the first month after childbirth.

The examination of 149 cases of inflammation ending in abscess showed that in only 17 women the disease was not associated with lactation; whilst in the majority, 132, it arose in those who were suckling. In 118 cases, either inflammation or abscess occurred in more than half of those who had given birth to a first or second child, and nearly one-third were primiparæ. An inspection of the nipple showed that in 97 cases of abscess this important part of the gland was imperfectly developed in 48, and diseased in 19, whilst it was well formed and healthy in 30. Thus we find half the cases associated with defective nipple; and adding to these the patients with unhealthy nipples, we have more than two-thirds of the cases of inflammation and its results complicated with, and probably excited by, malformations or diseases of the aggregation of the excretory ducts constituting that organ. As to the period after parturition when inflammation occurs, I found, in 116 cases, that it commenced during the first month after parturition in half of them, viz. 58 cases, and in a large proportion of these during the first week. In the other 58 cases, commencing after the first month, in 11 it began during the second month, in 8 during the third, in 22 between the third and eleventh, and in 17 between that month and the twenty-first. Now, as very few mothers continue to suckle for so long a time, it would seem that abscess depends very commonly upon protracted lactation, and probably the constitutional exhaustion excited thereby.

The above facts teach the following lessons, which, if fully accepted in that light, may prove of great importance and save much misery. They should induce the Surgeon to anticipate the probable result concurrent with the conditions described, and they furnish a substantial basis upon which to propose prophylactic measures in order to avert the ill consequences arising from them. Thus it behoves the medical attendant upon a primipara to examine carefully the condition of the nipples; and if there be any imperfection, to employ some means to excite their development, or, at least, to prevent the gland-tissue from becoming so gorged with milk as to conduce to subsequent mischief. Occasionally diminishing the distension by removing

small quantities of milk with a breast-pump will prevent inflammation and its results. Also, it often happens, when the gland-tissue is much congested, that the orifices of the ducts in the nipple are more than usually inverted, and that relatively with a more empty state of the whole organ the nipple becomes more prominent. The opening of one or more of the ducts is sometimes obstructed by an accumulation of epithelium, which is indicated, according to Dr. Ratzenbeck of Prague, by a very minute white projecting translucent vesicle. The milk-congestion of that lobe, the duct of which is thus blocked up, may be relieved by the withdrawal of the cause producing it.

Semeiology and progress of inflammation. The earliest deviation from a healthy state of the gland is usually indicated by more or less induration, which involves one or more of its lobes. Slight uneasiness in the act of lactation, or during the movements of the arm, often leads to its discovery, for in this stage (the first) the pain is not acute. Occasionally, patients state that a sensation of chilliness, or a shivering fit, preceded the discovery of the "lump, knot, or coring of the milk," as it is commonly called. In this stage, the secreting portion of the affected lobe is simply congested with milk, and especially the more solid portions of that secretion. The skin over the induration is not affected, and gentle manipulation of the part is tolerated without inconvenience. With very variable rapidity, in different cases, the induration increases; more and more of the lobes are affected, until at last the whole organ becomes involved in the disease. This constitutes lactic congestion. It sometimes takes place with but slight inconvenience, caused at least by pain, and without exciting much constitutional disturbance. In other cases, the disease advances rapidly; the skin becomes red, swollen, and even œdematous, usually over the primary induration; great suffering is caused, and severe constitutional excitement aroused. As time passes on, the length of which cannot be fixed with any uniformity, suppuration takes place, and the pus collects either in the breast, behind it, or upon its cutaneous surface.

Hence the division of mammary abscesses into three classes: superficial or super-mammary, intra-glandular, and sub-mammary. Each kind is characterised by a peculiar train of symptoms and very marked local indications, which we must now describe.

The superficial abscess, bounded by the cutaneous surface of the gland behind and the integuments in front, generally pursues a rapid course, and is not attended with very severe constitutional disturbance. In very cachectic women, however, the phlegmon is not limited; but it extends along the connective tissue around the whole gland, destroying it, and causing diffused suppuration, and, in rare cases, a wide-spread destruction of the skin. But in those superficial collections of pus, that fluid quickly makes its way towards the integuments, by the natural process termed "pointing," and the contents of the abscess escape. The usual local and constitutional symptoms accompany the morbid action, which it would be idle to describe here. (See INFLAMMATION, vol. i. p. 35.)

Intra-glandular abscess, the result of inflammation affecting one or several of the component masses of gland-tissue, is attended by local and constitutional symptoms of much greater severity than the variety last described. The pus collects within the fascia of the organ. The local pain is often agonising; the rigid texture of the gland-tissue, yielding slowly, compresses the inflamed structures, and the intense throbbing burning heat and heavy weight complained of are sensations with difficulty mitigated. The integuments slowly participate in the morbid action, and the whole breast sometimes becomes double the normal size before either redness or swelling takes place on the surface. At last, however, at a spot usually over the site of the primary hardness and painful point, the integuments yield slightly to pressure, where there may be also slight redness and œdema. From this the superficial inflammation extends, and, in a few hours afterwards, fluctuation of pus is felt. The constitutional symptoms are usually severe. After the first forty-eight hours from the discovery of the first hard spot, acute pyrexia is frequently developed, and accompanied sometimes with cerebral disturbance and excitement.

Sub-mammary abscess is characterised by a remarkable appearance of the whole organ. The breast seems to rest upon, or to be pushed forward by, something developed behind it; and, when slight pressure is used with the whole hand in a direction towards the thorax, the part feels as if it was resting upon an air-cushion or something elastic. This disease is generally slow in its progress; the local pain attending its development is commonly not so severe as in that last described, the redness of the integuments covering the breast is very slow to appear, and the nipple is often remarkably free from all disturbance. Constitutional reaction is not often excited until a somewhat late period; scarcely at all in some patients, until the fascia or the integuments, or perhaps the gland itself, become involved. The progress of the pus through the integuments is slow, and very often pointing takes place at several spots around the periphery of the gland; or the pus makes its way between the lobular masses of the organ, and an opening forms near the areola towards its sterno-clavicular border.

The treatment of inflammation must be conducted upon general principles; for those which are applicable in like conditions of other tissues of the body should be the guides for the administration of remedies when that disease affects the breast. However, a marked peculiarity of the organ affected arises from the fact, that it is an active secreting gland in a majority of the cases; and the disease is often developed soon after child-birth, and therefore intimately associated with the puerperal state. In these circumstances, then, we have additional elements which require some attention.

When merely a part of the gland is indurated and painful, without redness of the skin, a careful examination of the nipple should be made with the view to detect any obstruction of a duct or irritation about the orifice of one. Should the gland become much congested, mechanical means must be employed to remove the milk. Suckling need not be abandoned; but care must be taken that the gland-tissue is really fairly emptied of its secretion. The application of an evaporating lotion, or of one containing liquor plumbi, made warm before using it, frequently gives relief. The arm of the affected side ought not to be actively used; and a bandage should be adjusted in such a manner as to prevent the weight of the breast dragging upon the affected part. If the patient lie in bed, the breast may be supported on her chest, or a pillow may be arranged between the arm and affected side, upon which it may rest; a method which, in some cases, is more agreeable than a bandage.

Careful attention must be given to the condition of the alimentary canal, and a gentle aperient is often beneficial.

As soon as the skin becomes red, the local application of warmth and moisture is indicated. This principle may be carried out in many ways, the details of which it would be idle to relate here. The abstraction of blood, by means of leeches, may be useful at this stage; they should be made to bite at the periphery of the breast, nearest to the site of the inflammation, in preference to the part where the redness exists. The quantity of blood drawn must be regulated by the state of the general health of the patient, which commonly requires supporting rather than depressing. Nevertheless, in strong healthy young mothers, where the difficulty arises from deformity of the nipple, active local and constitutional measures are quite justifiable, and are frequently attended with great benefit. At the bedside, the practitioner has in fact, first, to establish clearly the cause of the inflammation; secondly, to consider carefully the constitutional condition of the patient; and the treatment of the case must be regulated by the indications afforded. One word of caution in reference to lowering the reparative powers of the patient. We believe that the practice is often carried too far, and that much greater advantage is gained by giving support at the time inflammation exists, not alone with the view to its resolution, but prospectively upon the chance of suppuration taking place.

Abscess; how it is to be opened, when, and where. The question is often asked, Is it advisable to open the abscess artificially, or leave the pus to escape by natural efforts alone? Should the pus be superficial, the local action circumscribed, pointing advancing without threatening destruction of much skin, and the constitutional disturbance trivial, the contents of the abscess may be allowed to escape by the processes of nature. But if the skin turns purple beyond perhaps an inch, and the cuticle peels off for a wider extent, the introduction of a lancet at the centre of the purple spot becomes necessary to prevent further extension of the mischief and gangrene of a large area of the cutis. The opening in an abscess of this kind should be free; a mere puncture will not suffice. It should be sufficiently large to allow the pus to escape readily; pressure to hasten its exit must be studiously avoided, that the walls of the abscess may collapse naturally; and the breast should be carefully supported with a bandage.

Abscess confined within the fascial envelope of the breast and between its component masses should not be interfered with too soon, unless the constitutional disturbance excited by the retained pus in its efforts to make its way to the surface be uncommonly severe. When, however, the skin becomes red and cedematous, a spot, softer and more yielding than the surrounding parts, may be generally detected. Very commonly this is discovered over the site of the primary hardness. Now, if the local pain be severe, the constitutional disturbance excessive, and the patient much exhausted by the tedious progress of the complaint, the introduction of a bistoury at the soft spot before mentioned affords almost instantaneous relief by diminishing the tension of the inflamed tissues, which was induced by the pressure of the fluid.

In cases of sub-mammary abscess the pus makes its way to the surface very slowly; the constitutional symptoms are not generally so severe as in the last-described variety; and it is in most cases desirable to seek the spot, from time to time, at which nature is effecting an opening for the escape of the pus. This most commonly happens somewhere around the periphery of the gland; rarely the pus burrows through it, in which case pointing takes place over that part of the breast where the gland-tissue is thinnest; *e.g.* in the quarter between the nipple and the sterno-clavicular articulation. In order that the pus may escape most freely, an opening at the lower border of the gland is considered preferable to one in any other part; but it may be as well to state that in this kind of abscess the disease is seldom cured after making one opening only. These are the cases in which numerous apertures are often formed; fistulæ and sinuses, traversing in several directions, burrow behind the gland

and between its compact masses, producing an amount of suffering, and depression of the system generally, very difficult to obviate. When the pus points, ordinary rules suffice to guide the Surgeon in the treatment of the case.

Other methods of emptying abscesses are employed by Surgeons. Some prefer to remove the pus by means of a trocar and canula, making at the same time a somewhat valvular puncture; and when all the pus has flowed, the sac is washed out with tepid water. The canula is then removed, and the whole organ strapped up in order to keep the walls of the abscess in contact. This method is reported as successful in effecting that which may be termed the primary cure of abscess. Others, after emptying chronic abscesses, inject solutions of iodine; and a vulcanised india-rubber drainage-tube, introduced into the cavity of the abscess, is said to hasten cicatrisation. These methods of treatment are not, however, generally available in acute abscesses, but may be employed in those of slow formation and unconnected with lactation.

Treatment after an abscess is open. For a few days it may be well to apply warmth and moisture to the surface of the breast generally; but we have not found any advantage to be gained by encouraging suppuration, as the long continuance of poulticing usually does. On the contrary, we prefer to cover the opening lightly with a small piece of wet lint or cotton-wool, over which very thin gutta-percha is laid, to prevent rapid evaporation, on the second or third day; and then to support the part carefully with a suitable bandage. The diet of the patient should be nourishing, not too stimulating, although there is no objection, if the patient be low, to allow some mild stimulant to be taken. Under similar conditions, tonics must be likewise administered.

Consecutive abscesses not unfrequently occur. This circumstance usually happens in those instances of general congestion of the whole organ before described. As a sequela of abscesses, sinuses sometimes remain a long time, being very difficult to heal. Stimulating injections, strapping up the breast with plaster, and applying a bandage methodically (p. 664), and, as a last resource, cutting them open,—are means towards inducing cicatrisation.

Milk fistulæ will not usually heal until the secretion of the gland is arrested.

Chronic induration of the gland-tissue may affect the whole of the gland, or only portions of it. The degree of hardness thus produced is sometimes sufficient to excite the alarm of the patient and the anxiety of the Surgeon. A minute examination of the gland-structure thus diseased shows that those tissues of the organ in which secretion takes place, that is to say, the cæcal terminations of the ducts, are the parts principally involved in the morbid action. During the inactive condition of the breast, when its tissues are soft and yielding, although somewhat firm to the touch, the cæcal terminations of the ducts are scarcely recognisable in the field of the microscope. Here and there, perhaps, a trace of them may be discovered by small accumulations of epithelium. But when the breast-tissue is indurated, the cæcal terminations of the ducts are gorged with epithelium, the acini become perfectly distinct, and in a somewhat excited state of the organ seems to be the cause of the development.

This morbid state is seen in breasts of all shapes and sizes; the large, heavy, pendulous variety is thus affected as well as the small, atrophied, disc-

shaped organ. When manipulating the first variety, the gland seems to be distinctly circumscribed, and it feels just like a great ball under the integuments; in the last, the fingers may be insinuated beneath its borders, and the whole mass feels like a quoit covered with skin. When a single mass of gland-tissue is affected, or perhaps two or three neighbouring masses together, or in different parts of the same organ, the indurations resemble tumours formed by a new growth, and they are frequently mistaken for adenocèles or cancer. The induration is most distinctly felt when it is pressed between the finger and thumb, or the breast is grasped from side to side and raised from the pectoral muscle. When pressed flatly against the chest, it is imperceptible as a hard mass. In most cases complaint is made of severe pain, and in some nervous excitable women the suffering occasioned is described as agonising. The slightest touch is scarcely endurable, and any pressure upon the induration produces an immediate outcry of distress, of which the countenance of the patient is also an index. The cheeks are often suffused with a bright-red blush as well as the throat and neck, although occasionally the effect of the sudden pain is to produce the very opposite result, when the cheeks become pallid, the pulse small, and a sensation of faintness, nausea, and even syncope may occur. But the pain is not confined to the affected breast. Patients complain of its wide-spread distribution, and some state that it shoots up the neck, others behind to the back and especially the blade-bone, and often down the arm. The Surgeon too will discover that the slightest pressure over the intercostal foramina, whence the mammary gland-nerves escape from the chest, either the middle or anterior branches, induces acute pain, and that sometimes even a single branch is alone affected, whilst all the rest are not. And it may be observed that the filaments of the painful branch are distributed to the indurated part of the breast. The pain is commonly paroxysmal, lasting various periods of time, and recurring without any assignable cause. It will sometimes even cease to be felt in the breast first affected and pass to the other; again change; and thus alternate from side to side. There is not a trace of any inflammatory action in the integuments. The breasts of unmarried women between twenty-five and forty years of age are most commonly affected; and of the married, sterile women are much more subject to this affection than prolific. General functional disturbance of the generative organs usually accompanies this state of the breast, sometimes indeed precedes it. The opposite derangements—amenorrhœa, menorrhagia, dysmenorrhœa, and commonly profuse leucorrhœa—are the manifestations. The general health is also much disturbed, the rest broken, and the nervous system highly excited.

The diagnostication is aided by the history of the case; *i.e.* by the age of the patient, her social condition, constitutional health, and functional derangement of the generative organs. Manipulation, methodically employed, also assists materially. If the nervous filaments be sought for and pressed upon, the pain induced is almost pathognomonic of the disease. When the hand is passed gently over the gland, nothing indicating the existence of a new growth is felt, which always happens when one exists; the induration is very distinct if compressed between the fingers and thumb, but imperceptible with the hand flatly placed upon the part.

The constitutional treatment consists in the employment of every measure calculated to improve the bodily health; thus, mild aperients, alteratives, various kinds of tonics, the mineral acids, iron, quinine, and in some cases sedatives, exert a very beneficial influence. As a topical application, the liquor plumbi diacetatis dil., an evaporating lotion, or even one slightly stimulating, may be employed. When the pain has not been severe, we have known instances in which the induration was dispelled after strapping the whole organ with plaster, having first covered it with ceratum hydrargyri comp., or strapping with emplastrum belladonnæ alone. All direct local pressure should be carefully removed; and if the breast be pendulous, it should not be allowed to hang loosely without some support.

Effusions of blood caused by contusions. Injuries of this kind produce swellings of more or less magnitude in the breast. If the blood be extravasated within the fascia of the gland, the skin does not always show ecchymosis. But the history of the case will generally aid in the correct diagnostication of the disease.

Of course such a swelling may show itself at any age after the development of the organ and in whatever state it may be; therefore some difficulty may not improbably arise in distinguishing between a tumour formed by extravasated milk and one by blood. But galactoceles are not often associated with violence well known to have been inflicted, whereas the blood-swelling always is. The first is painless usually; the last is accompanied with considerable pain. Inflammation and suppuration take place in these blood-tumours rarely; they generally diminish slowly, and at last disperse. A slightly stimulating lotion applied to the part hastens absorption of the blood.

Ecchymoses occasionally appear in the integuments over the breast in association with amenorrhœa; and discharges from the nipple of a blood-colour escape, under similar circumstances, which must be carefully kept distinct from those which occasionally accompany carcinoma of the gland.

Hyperæsthesia. Under the term more commonly in use, "irritable mamma," is understood an exalted state of sensation in the skin covering the breast, as well as of the gland itself.

The suffering which patients undergo is sometimes most intense. The very thought of a person touching the part adds to the torture, and even the gentle contact of the dress can be scarcely tolerated. The affected breast is usually larger than when in a healthy state; it is firm, conical, projecting; the skin is generally red, from its blood-vessels being congested; the nipple is prominent and appears swollen. This state of the breast is very variable from day to day, the pain being sometimes confined to one gland only, at other times to both, and occasionally alternating between one and the other. It will also suddenly cease, and return again as unexpectedly and without any assignable cause. Nor is the pain confined to the breast; it extends to the spine, neck, shoulder, arms, and hips. Young girls are more frequently thus afflicted than females above the age of twenty-five. Generally this affection is associated with an utterly disordered state of every function, a nervous excitable temperament, and especially derangement of the catamenial discharge, dysmenorrhœal, amenorrhœal, or the contrary. This condition is doubtless excited by sympathy with the pelvic generative organs, and may probably be induced by indulgence in depraved habits. Its treatment consists in enforcing strictly hygienic measures, all the excretions must be restored to a normal state, from which they generally widely depart, and the application of some soothing lotion at the moment of the more acute paroxysm of pain.

FUNCTIONAL DISORDERS.

Abnormal secretion of milk. This anomaly relates to the age of the woman and to a condition unassociated with pregnancy.

Cases are recorded in which the breasts of old women have secreted milk; others in which the secretion was formed at a very early age† (eight years);

* *Abridgment of Phil. Trans.* vol. iii. p. 80; Diemerbröck, *Anat. Corp. Human.*; Riberi, *Raccolta delle Opere Minori*, 2 vols. 8vo, Turin, 1851; Livingstone, *Missionary Travels, &c. in South Africa*, p. 126.

† Baudelocque, *Art d'Accouchement*, tom. i. p. 188.

and of some women, reputed virgins, whose breasts secreted a troublesome amount of milk.*

Agalactia, or want of lactic secretion, depends upon an organic imperfection of the gland, as already stated (pp. 659, 667), and occasionally upon constitutional causes. This secretion may be excited by the application of the leaves of the castor-oil plant to the breast,† as well as by warmth and moisture, and the stimulus of the act of suckling.

Galactorrhœa. This term expresses an excessive secretion of milk, which is constantly flowing away; as well as the continuance of the secretion after weaning, either at the conclusion of a proper period or as the result of a sudden removal of the suckling.

These conditions usually affect delicate females, and are associated with some derangement of the catamenial function. Measures to improve the general health must be enforced, and such medicines as give tone and power to the system should be administered. An application of the extract of belladonna over the breast, or even strapping it with adhesive plaster, will in some cases be useful. We have seen the preparations of iodine and of iron, given separately or in combination, exert a beneficial effect in these cases. Dr. Laycock recommends hemlock, used as a poultice and given internally with opium in pills.

Congestion with milk. The gland sometimes becomes excessively congested with its own secretion. This seems to depend on the more solid constituents of the milk being formed without the serous. For the more fluid portion appears to be an important agent, not only in diluting the nutritious element, but in favouring its ready escape.

It is probable that the sensation experienced soon after the infant is placed to the breast, called "the draught," is produced by more blood being distributed to the gland and a rapid development of serum taking place. In cases of the kind under consideration the breast assumes enormous proportions. It becomes of stony hardness. The skin is stretched, not much changed in colour at first; the nipple seems to be drawn in, but is rather imbedded in the skin, which is raised up around it, and flattened; the local pain is not severe; and although the mind is much disturbed by apprehensions regarding the nature of the disease and its ultimate results, the constitutional effects are not nearly so severe as, *a priori*, might be expected. The progress of the disease is excessively slow. Generally it terminates in inflammation and abscess. We may here observe that the morbid affection is usually confined to one breast, and that the function of the other one is performed in the most healthy manner. Also, that we have seen cases in which the gland, after regaining a healthy condition, was competent to the performance of its duties after a subsequent parturition. The disease for which this one is most likely to be mistaken is carcinoma. But that disease is so excessively rarely developed during suckling, that the bare suspicion of it may be at once banished; especially if

* Riberi, *op. cit.*; Heister, *Obs.* cclxxiii. p. 325; John Dix, in *Med. Times and Gaz.* p. 89, Jan. 1856; Braithwaite, *Retrospect*, vol. xviii. p. 376; Cases in *London Journal of Medicine*, vol. i. p. 85.

† The *Lancet*, Sept. 1850; *Edinb. Monthly Journ. of Med. Science*, Oct. 1850; *London Journ. of Med.* vol. ii. p. 951.

undoubted evidence can be obtained that there was no tumour in the breast before the birth of the child. The plain fact that the morbid state of the gland is immediately associated with the activity of the organ is, when accepted as negative evidence, almost pathognomonic of the nature of the diseased action. The treatment consists in strapping the whole breast with adhesive plaster, in the application of an ointment of iodide of potassium, iodide of lead, or the tincture of iodine, and in improving the general health.

SPECIAL DISEASES. DIVISION II.

NEW GROWTHS, FORMING TUMOURS, THE ELEMENTS OF WHICH MORE OR LESS RESEMBLE THOSE COMPOSING THE GLAND.

Adenocèle. This term is employed to indicate a kind of new growth, the tissues of which closely resemble those of the breast-gland itself. It is synonymous with the following designations: "Chronic mammary tumour," Sir A. Cooper; "Pancreatic sarcoma," Abernethy; "Tumeur adénoïde," Velpeau; "Corps fibreux," Cruveilhier; "Hypertrophie partielle," Lebert; "Mammary glandular tumour," Paget; "Hydatid disease of the breast," Sir A. Cooper; "Carcinoma hydatides," Sir C. Bell; "Sero-cystic sarcoma," Sir B. Brodie; "Cysto-sarcoma," Müller; "Tuberous cystic tumour," Cæsar Hawkins; "Proliferous cysts," Paget. Such a variety of names is sufficient to indicate the extreme diversity of outward form seen in these growths. Following their structural arrangements, we may make such a natural division of them as to include in three principal groups all the varieties met with in practice.

In the *first group* the growths are compact, dense, firm, fibrous, lobulated, and invested by their own fibrous capsule. The varieties in this group consist of new growths, in which the observer may detect ducts, sinuses, and even the secretion peculiar to this gland; of others, very succulent, in which ducts are traceable in progress of development; and of those not succulent, very fibrous, crisp, dense, minutely lobulated and possessing the caecal terminations of the ducts only. The surface of a section of the tumours in this group shows a very variable arrangement of the elementary structures. In some it is quite smooth, divided into larger or smaller lobes, and compactly united together by connective tissue; in others, it is broken up by fissures running in all directions and without any definite order; whilst in others, the surface is as irregular as it is possible to conceive, and appears as if the minute lobules would drop off from the general mass.

In the *second group* are cystoid^{*} formations having growths within them

* These so-called cysts resemble much rather the arrangement of the capsular ligaments of joints attached around the articular ends of the long bones than genuine cysts. It would be much more easy to comprehend the nature of both true cysts and of these envelopes of the new growths, if the word 'cyst' was exclusively restricted to a circumscribed cell or cavity bounded on all sides by a continuous membrane. In these adenoid growths, for the most part, it is the envelope or capsule of the new growth detached from its surface by the accumulation of fluid simply, which constitutes the so-called cyst. As this fluid is either absorbed or not secreted, the growth seems to encroach upon, or fill up and obliterate the cyst; but, without the growth increasing, if the fluid disappears, the capsule becomes compressed upon the surface of the new growth, and is more or less adherent to it.

which appear to spring from their walls, are floating and pedunculated, or sessile, and have very little connective tissue between them. These intra-capsular growths are often bathed in fluid. Variety appears in this group by the tumours being composed of large lobed, pedunculated masses, not connected together, although each lobe consists of lobules containing acini and the caecal terminations of the ducts, together with connective tissue. In other specimens the small lobulated masses are attached to membranous septa from which they are pendent; and in others, sessile masses are dispersed upon the wall of a large membranous capsule which contains the characteristic serum. This fluid is usually of a pale yellow tint, tenacious, adheres to the fingers, and draws out in threads. Any deviation from this colour is due to the admixture of colouring matter from the blood.

In the *third group* we arrange those cystoid formations referable to the dilatation of the ducts or sinuses, and connected with them, which contain growths apparently springing from their walls and composed of tissues resembling those of the gland. Sir B. Brodie first described them, and they are very rare (*Lectures on Pathology and Surgery*, Lect. vii.). A drawing of a very fine specimen of this disease is published by Dr. H. Meckel in the *Illustrirte Med. Zeitung*, 1852, b. i.

Adenocoeles usually commence as a hard nodule upon the cutaneous surface of the breast, in its substance, at its border, or behind it. In some instances their mobility and isolation from the organ are aids towards diagnosis; but when they are imbedded in the gland, or developed behind it, these features are not recognisable. When the new growth has reached a considerable size, the true breast is frequently atrophied. Rarely both the right and left breast have tumours developed in them, and it is uncommon to meet with two or more in the same organ. We have been unable to prove that one breast is more liable to this affection than the other. A patient was, however, under my observation, in whose breasts numerous tumours were developed, varying in size from half an inch in diameter to two or three inches. The rapidity of their growth varies greatly in different patients. Those possessing a cystoid character increase more rapidly, as a rule, than the dense, compact, fibrous structures. In several museums enormous masses of all kinds are preserved, which weigh many pounds. The integuments usually accommodate themselves to the stretching to which they are subjected without ulceration taking place, although in some few instances we have seen them become gradually thinner and thinner over a single cyst, and ulcerate. This allows the escape of the serum, after which a hole continues in the skin, the features of which are distinctive of the disease beneath. The edges of the ulcer are thin and lie flat upon the intra-capsular growths, neither inverted nor everted; they are not even adherent to it, but can be raised from it with facility. In one instance, and where the tumour was not large, the integuments sloughed, after which the whole mass projected through the opening in the skin and formed a red fungating growth, which assumed the aspect of cancer. As a rule, the more dense and fibrous kinds grow slowly. When in the gland of a young girl, their rate of progress seems commonly to be from about half an inch to one inch in twelve months. Such, at least, is the nearest estimation I can form, after watching them in patients who would not submit to their removal. Having attained a moderate size, their growth sometimes ceases. Those tumours associated with cysts always grow the fastest. One notable exception to this we have observed. It occurred in a maiden of twenty-three years old, from whom Mr. Nathaniel Ward removed a tumour of two pounds' weight, which had grown in about eight weeks, according to the statement of the patient. It was chiefly composed of succulent fibre-tissue and the epithelium of the mammary gland-ducts and caeci.

Sudden and rapid increase in size occasionally happens in these cases, accompanied with more or less redness and vascular congestion of the cutaneous covering. This change is due to two causes operating upon the tissues of the new growth. One is inflammation passing on to destruction or necrosis of its

central portions; the other depends upon intra-capsular hæmorrhage. A case of this kind is reported by Mr. Bryant.* In another case,† under the care of Mr. Kellock and the writer, a sudden enlargement of the tumour was observed a few days before parturition. The growth was of several years' development; and when removed a large cyst was found in it containing a mixture of milk and serum.

These tumours are developed at any age, about puberty or subsequently. Sometimes they form simultaneously with the development of the gland, rarely with the changes taking place during pregnancy, but most frequently at the stage of passive maturity of the breast. Thus, of any large number of cases, the third decade of life, which includes the ages between twenty and thirty years, offers the majority of examples. But care must be taken to note the age of each individual at which the tumour was first observed, and not that at the moment of examination. The writer found the proportions to be as follows, in 125 cases, from birth to fifty years old. During the first ten years there was not a case; from ten years to thirty, 90 cases; from thirty to fifty, 35. In a very large majority of the cases, the women were single when the tumour was first noticed; and when married women were the sufferers, the majority had been prolific. The patients were generally remarkably healthy. Very little inconvenience is caused by the growth in its early stage; indeed, very often the patient is only made aware of its existence by accidentally touching it. In a very few cases the discovery of the "lump" was preceded by a contusion. Just before the catamenial period a little pain may be felt; but that, perhaps, does not exceed the usual irritability of the organ prior to its recurrence. Even when of great magnitude and their bulk intolerable, the freedom from pain is remarkable. It is right, however, to state that in a few cases we have known the patient to complain of severe pain; and that, in one instance, with this accompaniment, a filament of a nerve was traced into the new growth. The general health of the sufferer is unaffected in the first instance; but at last the bulk of the growth, and the mental anguish induced by anticipation of its results or necessity for an operation, prey upon the constitutional vigour of the patient, and it becomes impaired, whilst, at the same time, the facial aspect is indicative of depression and anxiety.

Of recurrence and alternation of these growths after removal. The growths classed together in the first group very rarely reappear after excision. We have never seen a recurrence in a patient in whom the tumour was developed before thirty years of age. But in older women, and especially when the tumour resembles those constituting the second group, recurrence is not infrequent, particularly if the entire mammary gland has not been carefully removed with the tumour. The truth is, that the more closely the tissues of these growths resemble the elements of the fibro-plastic formations, the greater will be the probability of their re-appearance locally, and, we may also add, in one or other of the internal organs. An interesting feature of those cases in which the mammary growth has been repeated consists in the varieties of the first and second groups alternating with each other. For example, the first growth may be solid, firm, fibrous, and its section resembling the cut surface of the mammary gland; but the second tumour shall have the cystoid formation; whilst a third may assume all the characteristics of the first. And often, in different portions of the same tumour, these growths are found associated together, invested by a common envelope. Do we not in these loosely constructed growths recognise the propriety of applying the term 'capsule' to the fibrous membrane surrounding the adenoid growth, rather than adhering to the word 'cyst,' which carries one away from the relations really subsisting between the capsule and the new growth within it?‡

* *Trans. Path. Soc.* vol. xii. p. 222.

† *Ibid.* vol. ix. p. 386.

‡ Brevity being compulsory, the reader is referred to a paper on adenocèle in *Guy's Hospital Reports*, 1855, in which a large number of cases is reported by the writer.

Diagnosis. The age of the patient and her healthy aspect ; the condition of the breast, the locality of the growth, in many instances ; its firmness, mobility, and freedom from pain, except perhaps after pressure,—are the chief points from which aid is derived in correctly diagnosing the fibrous compact varieties of adenocoele, developed in the breast of maidens *before* thirty years of age. After this period, the cystoid varieties most commonly prevail. These tumours are characterised by their nodulated and lobulated surface, in which irregularity of course the integuments participate, so that the uniform roundness of the surface of the breast is marred. The elevations and depressions correspond with the collections of fluid and masses of solid new growth. Often when the finger is pressed over the most prominent, the fluid can be displaced, and the indented surface of the intra-capsular growth detected by sight as well as by touch. A combination of these capsules with their solid contents, in larger or smaller masses, together with perfectly solid growths, can be diagnosticated by manipulation. In some cases the bold relief of the tumour upon the thorax, and its striking projection against the integuments, as if it were ready to burst through them, is highly characteristic, especially in marking the important distinction between an independent new growth developed in the organ, and those new formations which, infiltrating the tissues of the gland, do not essentially interfere with its normal outline.

The *prognosis* of this tumour is for the most part favourable. When the growth belongs to the first group, it is always so. But when the fibro-plastic elementary tissues appear, the Surgeon must bear in mind the statements before made, and pronounce with caution.

The *treatment* consists in removing the tumour by excision. We have never seen the slightest advantage gained by local applications, nor are we disposed to admit that a genuine new growth of the nature before described is ever absorbed. Isolated and circumscribed lobules of the true gland, which from their hardness and mobility closely resemble these new growths, certainly disappear when the healthy condition of the gland is restored ; but is a genuine new growth ever absorbed ? We believe not. On small tumours the operation is very simple. The integuments should be stretched over the growth tightly, and the point of the scalpel inserted sufficiently deep to penetrate its anterior surface to the depth of about a quarter of an inch. The capsule is then cut by drawing the edge of the scalpel through it. Its handle is next made use of to detach the connexions between the capsule and the growth, and where the fibrous tissue enters between its component lobes the blade is used. After this manner it is easily enucleated, without cutting the breast-gland itself. When the adenocoele is covered anteriorly by the gland-tissue, the operator must make an incision through that structure, and open the capsule as before described. The edges of the wound are to be kept in close apposition with plaster. This proceeding should be adopted in the majority of patients under thirty years of age. As a rule, however large the growth, the gland should be sought out and preserved, if practicable, in young child-bearing women.* After thirty-five, unless in exceptional cases, we deem it preferable to remove the entire breast with the growth.

Duct-cysts. Perfectly closed cysts, and others so called, but having an opening communicating with a duct, which in some instances is so large that the swelling assumes rather the character

* The reader is referred to Mr. Stanley's case, prep. no. 208, in the pathological Museum at the Royal College of Surgeons ; the report of the case in *Guy's Hospital Reports*, 1841, p. 203 ; and its subsequent history in the volume for 1855, p. 144, case v. ; also another case, p. 139, case i., in the same book.

of a dilatation or bulging of the walls of the tube, are frequently met with in the breast. Their contents more or less closely resemble the mucoid secretion found in dilated ducts. Hence their assumed origin and the term by which they are designated, duct-cysts; or, from the nature of their contents, mucous cysts.

The wall of the cyst is usually thin, firmly united to the surrounding parts, and consists of fibre-tissue. Its interior is smooth, and covered with pavement epithelium. The contents are either a thick tenacious mucus, of a dull green, yellowish, or brownish tint, and slimy, greasy consistence, which renders water turbid, but does not readily mix with it; or if the cyst be large, the fluid is more serous, with an admixture of blood, causing its colour to assume a dark red, brown, or blackish hue. Laminae of chlorestherine often float in the fluid. Sometimes only a single cyst forms in one breast; in other cases cysts abound in one or both. Indeed, one rarely fails to find some of them of minute size, if the gland of a woman of middle age and who has suckled several children be examined after death. Of course, examples of this kind give no trouble; but when the tumour reaches one or two inches in diameter, and produces a hard, fluctuating swelling in the breast and a blood-coloured fluid oozes from the nipple, considerable alarm becomes excited. Such swellings are developed in any part of the breast. Most commonly, however, when large, they are placed superficially, near the areola, and in the neighbourhood of the larger ducts. When numerous and minute, the posterior and peripheral regions of the gland seem to be the parts usually selected for their development.

This disease is always met with in the passive state of the gland, and in adults who have reached or passed the middle period of life. It occasionally occurs in single women, but most commonly in those who have been mothers and suckled children; although married but sterile women are not exempted. In different cases and at various stages of the growth, the accompanying pain differs much. In some, this morbid condition is painless. When the cyst is very large—a condition which, however, rarely happens—the fluctuation of its fluid contents is very distinct; and when small and numerous, the same may be detected in the separate cysts, although they often feel so very hard as to deceive the careless observer. By gentle compression of the cyst the fluid sometimes escapes from the nipple, which occurrence may almost be accepted as pathognomonic of this disease, and especially, too, if the cyst can be thus entirely emptied. But should a solid substance be felt after the escape of the fluid, the probability is that some other disease exists, associated with the cyst. As the cyst enlarges, the integuments covering it become thinner and thinner, until the coloured fluid it contains produces discoloration of the skin. Such altered colour of the tegumentary texture, from that circumstance alone, is a notable fact, and one which must not be confused with the colour depending upon congestion of its blood-vessels, or infiltration by inflammatory or other products. The tint of the overlying skin is either pink, red, purple, or brown. At length ulceration of the skin takes place, if the disease be allowed to take its course, and the fluid contents of the cyst escape. In some cases the opening heals; but, as the wall of the cyst remains, it soon becomes again distended with an accumulation of fluid. We have known this operation to be repeated over and over again, occupying a period of several years, and merely giving rise to trouble and annoyance.

This disease being of purely local origin and usually occurring at a period of life when the organ is no longer required, two methods of treatment are offered for selection. The palliative treatment consists either in emptying the cyst by compression, when its contents flow freely from the nipple, or by making use of a trocar and canula for the same purpose. A radical cure can only be effected by the removal of the entire breast. All external local

applications are unavailing for the cure of the disease; but if a single closed cyst exist, it may be emptied, and a drachm or less of the tincture of iodine injected and allowed to remain there. Obliteration of the cavity sometimes follows this treatment. When the disease originates as above described, to the exclusion of every other, the prognosis is favourable; but it cannot be denied that a great tendency exists to the development of these cysts in association with carcinoma. In certain cases, therefore, a guarded prognosis is desirable. Preparations illustrating this disease are to be seen in the College Museum, nos. 2742, 2744; and in Guy's Museum, nos. 2290⁵⁵, 2290⁶³, and 2290⁷⁰.

Galactocoele—a milky tumour, or a swelling caused by rupture of the milk-tubes and escape of their contents into the surrounding connective tissue, or dilatation of a lacteal duct or its sinus from obstruction—is rather a rare disease, and always developed during the active state of the organ. If it occur at an early period of lactation, and in consequence of rupture of a large duct or one of the sinuses, fluctuation is perceptible in the tumour; it increases rapidly and distinctly during every time the infant sucks. On the other hand, should the extravasation proceed slowly, but little observation is taken of it; and having attained variable dimensions, the tumour sometimes remains without alteration for some time.

Slowly the serous portions of the milk are absorbed, and the more solid, fatty constituents remain, causing the swelling to decrease and to become firmer. It may at last feel quite hard, the cyst-wall becoming rigid and crisp, which depends upon the deposition of earthy salts. In this stage a difficulty may arise in distinguishing the precise nature of the tumour. The swelling, during its formation and subsequent progress, is unattended with pain; the colour of the overlying integuments is unchanged, and the general health is not affected.

The diagnostication of the swelling, when first formed, is made by calling to mind the condition of the organ at the moment of its development; its sudden formation during suckling, and the changes produced in it concurrently with that act; the fluctuation; the unaltered colour of the integuments; and the freedom from constitutional disturbance. At a later period, the Surgeon must be guided by the history of the case, its negative indications, his experience of other tumours in the breast, and manipulation.

The treatment consists in puncturing the integuments and the cyst, allowing the free escape of its contents, and encouraging the wound to heal by granulation.

A preparation showing the lactiferous tubes dilated and filled with milk is preserved in the College Museum, no. 2741; and others, showing a cyst which contained milk, in Guy's Museum, nos. 2290⁸⁰, one a mass of casein, 2299¹⁰, and 2290⁵⁰.

Sero-cysts are characterised by the nature of their contents, the globular outline of their form, the simplicity of their structure, and their harmless influence. The cysts so commonly found associated with the new growths termed adenocoele are designedly excluded from this category, as their contents are peculiar and characteristic.

The fluid of the true sero-cyst is limpid, colourless, or very pale yellow, and sometimes just tinted with the colouring matter of the blood. It is clear, occasionally very slightly turbid, and never tenacious. Neither the application of heat nor the admixture of nitric acid cause any coagulation, although a very slight flocculent precipitate may subside as the liquor cools. The cyst-wall is very thin, composed of fibre-tissue, firmly attached to the surrounding parts and lined with tessellated epithelium. It is always perfectly closed, and never communicates with a duct. Usually a single cyst only is found. Its existence is discovered by the patient, whose attention is drawn to a painful spot, perhaps, where the finger detects a small hard "lump." This discovery may have been made some time after the receipt of a contusion in the region, which merely produced temporary pain, and was in the interval forgotten. Other cases have occurred, for which the patient was totally unable to assign any local cause. As the fluid is slowly secreted, the tumour progressively enlarges, and if seated superficially, elevates the skin, producing, therefore, unusual fulness of the affected organ. If it be near the nipple, that organ is sometimes pushed aside; and if the maiden state of it exists, it may be flattened out and lost to touch, although traceable by sight. It is never really retracted. The skin at last becomes much stretched over the tumour, without showing any other marked structural change, and by a careful adjustment of a strong light, the surface of the swelling appears translucent. Fluctuation is of course distinct, together with the characteristic vibration of a circumscribed collection of fluid when gently and suddenly tapped with the finger. By degrees, the pressure of the fluid acting upon the skin, its vessels become congested, and sometimes its capillaries dilated; but there is little really inflammatory action until the last moment. Then ulceration takes place at a very small spot, the fluid flows out, the cyst collapses, and a serous scarcely-coloured discharge continues to escape. That aperture sometimes closes and never re-opens; in other cases, the processes above described are all repeated. These cysts are developed at a somewhat earlier age than those termed "duct-cysts." They are generally painless; but in nervous irritable women they are sometimes described as being painful. The general health is undisturbed, and the catamenial function normal.

The treatment consists in emptying the cyst with a trocar and canula, after which an embrocation should be applied over the part, consisting of hydrochlorate of ammonia, spirits of wine, and camphor mixture. Sir B. Brodie states* that he has cured cases, probably of this kind, by the mere application of a lotion composed as follows: R Sp. camph. sp. tenuior., ana fl. oz. iijss.; liq. plumb. diacet. fl. oz. j. This must be applied on a piece of flannel, once folded, over the site of the tumour, renewing it six or eight times in the day and night, until the skin becomes inflamed; then desisting for two or three days, and again using it. He adds that "three or four weeks," and in some cases "some months," elapse before this treatment is successful in effecting a cure.

Lipoma and excess of fat. Masses of adipose tissue are occasionally developed on the breast, within it, and sometimes behind it. As age advances, fat is frequently generated in the place of the gland-tissue, so that what appears to be a largely developed organ, really consists of fat-tissue only, through which a few ducts radiate from the nipple.

* *Lectures illustrative of various subjects in Pathology and Surgery*, 8vo, 1846, Lect. vii. p. 156.

But in early life, tumours composed of fat (true lipoma) have been removed from the breast.* Mr. Roper, of Croydon, sent to the Museum at Guy's Hospital several pounds of fat (prep. 2300^{so}) which had been growing in the site of the mammary gland for fifty-eight years. A tumour was first noticed by the woman in her thirtieth year. She died at the age of eighty-seven years, having been merely troubled with the bulk of this pendulous tumour, which measured twenty-three inches around its largest circumference. In its centre there was an irregularly-shaped piece of bone. The same collection contains a portrait of the patient and tumour taken during life. At an early age, and in persons disposed to obesity, these organs become enormously loaded with fat.

Vascular growths, very rarely met with pure, are generally associated with carcinoma. That is to say, the new growth contains a large number of vessels, and bleeds freely when wounded. The case published in the *Medico-Chirurgical Transactions* (vol. xxx.), which is reported by Mr. Image, may be referred to. There is also a case related in the *American Journal of Medical Science*, no. xxxv.

Neuromata are developed on the cutaneous nerve-filaments, as well as probably on those within the breast. Their presence is recognised by the usual indications, which require no special mention here.

Enchondroma and osteoid growths. New growths of tissues resembling those constituting special systems of the body are very rarely found in the breast. Thus it is extremely uncommon to meet with tumours composed of either cartilage or bone.

Sir Astley Cooper relates the case of a woman, thirty-two years old, who had observed a tumour in her breast for fourteen years. When removed, the growth consisted of two portions: "the larger portion of it had the appearance of that cartilage which supplies the place of bone in the young subject; the remaining part was ossified." Also Prof. J. Müller† writes, in reference to four cases of enchondroma: "In all of these four cases the parts affected were glandular structures, namely, in one instance the parotid gland, in another the *mammary gland*, and in the remaining two the testicle" (Dr. West's trans. p. 102). In old books we find reports of cases in which bony masses or concretions have been found. In old women, and in cases of extreme atrophy of the breast, the arteries are not uncommonly converted into bony tubes: see preparations in the Museum of the Royal College of Surgeons, 2811, 2812, and one in Guy's Museum. Of earthy concretions there are several preparations in the Museum at the College (*Path. Cat.* vol. iv. p. 342).

* Remarkable cases of lipoma are recorded, as follows: Sir A. Cooper removed more than fourteen pounds of fat, *Illustrations of the Diseases of the Breast*, p. 67; and another case, p. 68. Sir B. Brodie relates a case in *Lectures on Pathology and Surgery*, p. 271. Warren excised eight pounds of fat, *On Tumours*, p. 228.

† *Ueber d. feinern Bau u. d. Formen d. krankhaften Geschwülste*; fol. Berlin, 1838.

SPECIAL DISEASES. DIVISION III.

NEW GROWTHS COMPOSED OF ELEMENTS FOREIGN TO THE NORMAL TISSUES OF THE BODY.

Hydatid cysts. Cysts containing entozoa are occasionally met with in the breast.

Two cases have been seen by the writer. One of them occurred in a woman fifty-one years old; the other was twenty-nine at the time of the operation for the removal of the disease. Both were patients in the hospital. In the elder of the two the swelling in the breast had existed eleven years; in the other one six years. They both enjoyed very good health. The tumours measured about three inches in diameter; they were distinctly circumscribed, firm, painful when pressed, and fluctuation was very distinct. In one case Mr. B. Cooper removed the whole breast, together with the tumour; in the other, Mr. Cooper Forster removed the cyst and its contents only. The large sac containing numerous globular hydatids was very characteristic, and with the aid of the microscope the tentacles of echinococcus hominis were apparent in both instances. We are unable to distinguish between those cysts containing entozoa and others filled with serum or even pus; but the length of time which the tumours have existed, their slow increase, and painless nature, together with the negative evidence to be acquired by sight, touch, and the history of the case, should dispose the Surgeon to open the cyst freely before cutting off the whole breast.

Fibro-plastic growths. Under this term we include a class of new formations, the elements of which are nucleated cells of a fusiform or oval shape.

The tumour increases rapidly, and becomes much identified with the breast, although the gland-tissue is not infiltrated with the new elementary structures; the integuments ulcerate, and allow a fungating, sprouting growth to burst through the opening. This disease is not very commonly developed in the breast. Sometimes it is associated with adenoid growths, and springs up in the gland of rather youthful women, who seem to be in the enjoyment of remarkably good health. Judging from the cases which have fallen under the observation of the writer, the recurrence of the growth is almost certain to ensue after removal, and the probability of the viscera of either the thorax or abdomen containing identical growths is almost equally great. It chiefly differs from the adenoid tissues in being developed at a rather later period of life, in the rapidity of its development, and by assuming externally some of the appearances of carcinoma. In truth it has not perhaps sufficiently characteristic external indications to enable a Surgeon to distinguish between it and carcinoma during its growth, but its elementary constituents differ widely from those of carcinoma. When not interfered with, the tumour often attains enormous proportions, and sometimes the centre softens down, or the whole mass sloughs. It is more vascular and succulent than carcinoma, and when ulcerated often bleeds profusely. The glands of the lymphatic system of the breast are not involved in the disease, even at the latest period. In our experience the removal of the disease has only been attended with temporary advantage, yet we do not hesitate to sanction this step, as it is the only one by which the patient has a chance of being saved from acute local suffering and a speedy death.

Colloid growths. This new formation, termed by Prof. Müller "collonema" and "carcinoma alveolare," is very rarely found in tumours of the mammary gland.

Most specimens of the disease have been taken from other parts of the body. We have seen but two examples on living persons, and there was nothing sufficiently characteristic then to lead to its identification. But it is quite the contrary when a section of such a growth is examined. There is not one so marked, so distinct, so easily recognisable. The transparent jelly-like substance is arranged in compartments, the walls of which are formed of a delicate fibre-tissue. In the specimens we have seen the colour has differed, but that has merely been owing to the admixture of the colouring matter of the blood. Very little change takes place in the appearance of the section after immersion in dilute rectified spirits of wine, but the jelly oozes out slightly and projects from the alveoli, forming a delicate flocculent surface. There seems to be a tendency to local recurrence in these growths, and therefore the whole of the affected organ should be removed; especially, too, as preparations show that isolated centres of the growth are disseminated freely around the principal mass.

Carcinoma, a disease generally known by the term 'cancer,' is more commonly developed in the breast than any other growth. It is found under three very distinct forms. First, the infiltrating kind; secondly, the tuberos; thirdly, the cystiform, or associated with a cyst or cysts.

In the first variety, the normal tissues of the breast, whether in a healthy condition of passive maturity or more or less atrophied, appear to be infiltrated with a fluid and nucleated cells. If the diseased organ be examined at this stage, its appearance, to the unassisted eye, differs but slightly from that of a gland affected with chronic induration; that is to say, it is hard, condensed, incompressible, and sometimes rather granular on the surface of the section. When the part is examined by the aid of the microscope, the nucleated cells, identical with those found in tumours generally acknowledged to be cancer, are easily seen in the fluid oozing from the tissues. In thin sections of such a diseased breast, these nucleated cells are found to be arranged in small groups, between the fibres or stroma of the organ. This stage of cancer has often deceived superficial observers; for cases of this kind have been recorded in which, after the removal of a tumour not recognised to be cancer, that disease has subsequently developed and killed the patient. The entire gland, or a single lobe, may be thus infiltrated. After the lapse of time, the diseased tissues lose their identity, and they become harder, compact, and of an uniform, grayish tint. They no longer maintain any resemblance to the section of a mammary gland, although, perhaps, a few ducts may be indistinctly traced. The next marked change is that which is chiefly characterised by the contraction of the growth. The tumour is now as hard as a stone. It may be crushed by pressure, scarcely torn. The surrounding textures, not those of the breast only, are drawn towards it, for it seems to have formed a sort of nucleus or centre, attracting all the neighbouring parts. Upon the cut surface of such a tumour the remains of the ducts are often traceable, forming a finely reticulated figure. This is *carcinoma scirrhosum*, or the scirrhous cancer, or stone cancer of old writers and the public; *carcinoma fibrosum* of more recent authors.

The changes before described, which take place in the infiltrating variety of cancer, may often be observed in the different masses of the same gland after its removal. Thus in one part where the tumour has existed the longest time, and over which the integuments are dimpled or puckered, the gland-structure will be found to be entirely destroyed, and just a trace of ducts perceptible. In this part the active growth of the disease would appear to have become arrested, its progress terminated. We often meet with cases in which the entire gland, having been at one time so infiltrated (in which case the disease usually commences in the centre of the organ), subsides into a

mere hard nodule, and gives little trouble, if any at all. In another part, the gland-tissue has lost its characteristic features. The ducts are traceable into it, however, and it may still retain an indistinct lobulation. All the interstitial fat has disappeared. The disease has here been growing a comparatively short time, and in sections of such a tumour the elementary structures of carcinoma are well seen. At another part, the section of the gland-tissue appears to be merely indurated, its lobulation is marked, and small lobules of fat are still interspersed. The condition of this portion is the result of quite a recent change. It is due to the earliest stage of infiltration, and the elements of cancer-growths exist there. Thus these three stages of infiltrating carcinoma may be clearly demonstrated in different regions of the same breast, as well as in three separate glands removed from three distinct individuals. We have not space to give here a description of the minute anatomy of these growths at the three stages above described; but it should be stated that their elementary structures, invisible without the aid of a microscope, are quite as characteristic as the appearances to the ordinary vision.

The tuberous variety of carcinoma forms a distinct tuber or circumscribed mass in the breast, quite within its fascial envelope. Its synonyms are numerous. Thus, if soft and brain-like, *C. medullare* or *cerebriform*; if firm and solid, *solanoid*; if jelly-like, *gelatiniform*; when black, it is called *melanic* or *melanosis*. Having ulcerated through the integuments, it is called *fungoid*; and if profuse hæmorrhage supervene, the term *fungus hæmatodes* has been employed to mark the fact. But the single feature which most distinctly characterises this form of carcinoma is its isolation from the gland-tissues by means of a more or less well-defined membranous capsule. Thus the tissues of the breast itself are pushed aside by the encroachment of the new growth, and, as they are not at first absorbed, the dimensions of the affected organ, in comparison with the healthy one, accord with the progressively increasing development of new tissue. Contraction, a feature so characteristic of infiltrating cancer, does not occur in this variety. Therefore the progress of tuberous cancer more or less rapidly advances, in the majority of cases, to the formation of a tumour of considerable dimensions. Distinct and separate nuclei of tubers are occasionally developed in different parts of the same breast. By degrees they coalesce, and form one large growth. Again, the tissues of a single tuber will occasionally burst through their envelope, as it were, and form a very large lobulated mass, which separates the breast into several divisions.

The cystiform variety of carcinoma, or a growth of cancer-tissue associated with a collection of fluid circumscribed by a fibrous capsule or cyst, scarcely possesses sufficient individuality to allow of its admission as a distinct *species*, though its *form* is distinct. The solid growth belongs usually to the tuberous form, and the collection of fluid which always bathes a larger or smaller portion of its surface is really but an accidental formation. In morbid structures of this nature, the cyst seems to have attracted the notice of anatomists in a more marked degree than the solid growth. Thus we continually meet with the expression, "the growth from the cyst-wall," whereas, when cases of this description are watched during the growth of the disease, the collection of fluid is often progressively formed upon the surface of a solid tumour. In such a case, the cyst which circumscribes the fluid is a secondary formation, and the solid growth was the cause of its development in the following manner. All Surgeons must have observed the quantity of serous fluid poured out from tubers of cancer over which the integuments have ulcerated. This serum flows away in the absence of any thing to allow of its accumulation. But let the fluid ooze from a growth of cancer surrounded by a fibrous envelope, and it will collect, when in excess, between the envelope and the growth, and, separating the capsule further and further, a larger and larger cyst will be developed. Now, if such a tumour be removed, and the walls of the cyst cut open opposite to the growth, the membranous structure falls collapsed, and a solid substance seems to bud forth from its tissues. But make such a single section of the tumour as shall

divide the capsule and growth into symmetrical halves, then the relations of the solid growth to the envelope of the fluid will be visible. The observer will notice that he has before him the section of a solid growth of cancer, limited by a more or less distinct membrane, and united with the surrounding tissues of the breast. The 'cyst' will now appear in a different relation. It may be traced in continuation with the fibrous envelope of the tumour, which is, however, more delicate than it, but clearly identical. The surface of the growth, bathed by the serum, has not this envelope; for it has been separated from it by the continual oozing which has taken place, at the same time becoming thicker. Thus the only peculiarity possessed by such a growth of cancer is the addition to some part of its surface of an accumulation of serum in a fibrous capsule. The serum is generally deeply tinged of a brown tint. It is often quite clear. After standing a few hours in a test-tube, blood-discs are precipitated. Heat, or nitric acid, being applied, more or less turbidity or coagulation takes place. After the serum has been removed through a canula, it generally rapidly collects again. This variety of cancer long ago attracted the attention of Surgeons, and several writers have alluded to such cases under the title of "bloody cysts in cancerous breasts."

Age when carcinoma is most commonly developed. The fifth decade of life is that in which carcinoma is most frequently developed in the breast; that is, from the 40th to the 50th year. Before 20 years of age the writer has never seen a case.*

The table below shows the proportion of cases at various ages. Most of the cases were under the observation of the writer; they have not been in any way selected by him, and great care was taken to note the age at which the disease was first observed:

Age from 20 to 30 years	.	.	.	.	.	.	19
" 30 " 40 "	.	.	.	.	.	.	100
" 40 " 50 "	.	.	.	.	.	.	193
" 50 " 60 "	.	.	.	.	.	.	97
" 60 " 70 "	.	.	.	.	.	.	34
" 70 " 80 "	.	.	.	.	.	.	6
" 80 " 90 "	.	.	.	.	.	.	7
" 90 " 100 "	.	.	.	.	.	.	2

458

Even taking into the calculation the disproportion of individuals alive at any definite periods, the numerical proportion here given shows that an excess of cases belongs to the fifth decade; for only 36 less than half the total number appear in those ten years, or rather more than two-fifths against all the cases at other ages.

The constitutional nutrition of persons afflicted with carcinoma varies, at the development of the disease, between the appearances of robust health and general cachexia. In some cases late in its progress, or even in the last stages, its ravages upon the general health are not very apparent. Some writers assert that, if careful inquiries be made, it will be in most cases ascertained that the state of the general health has been below the average healthy standard for some time previous to the discovery of the disease. But, after the most careful researches in reference to this most important point, the writer has been unable to arrive at any definite results. The statement may certainly be made, without fear of contradiction, that all circumstances tending to depress the vital powers are very commonly associated with the development of cancer. Thus severe mental distress, losses of blood, poverty,

* Mr. Lyford (*Lancet*, vol. xii. p. 332) and Mr. B. B. Cooper (*Lectures on Surgery*, 8vo, 1851) each record a case; the former at eight years of age, the latter at thirteen. In the Museum of St. Bartholomew's Hospital, the preparation ser. xxxiv. 4 was removed from a girl aged sixteen years.

intemperance, are commonly marked features in the history of the lives of individuals afflicted with this disease. Still, who would be bold enough to assert, after much experience of the vicissitudes of social life, or of the habits of the people, that these are predisposing causes to its development? Surely, if they were, the disease would be even much more common than it is.

To the cessation of the catamenial function it is usual to refer some baneful influence, and thus to associate cancer with this natural result. But, after careful inquiry, it is found that, of any given number of cases, in a large majority of the women the function is persistent at the moment of the development of the disease. Thus, abstracting this fact from a hundred cases, not selected, but as they chanced to come under observation, we found that the catamenia were persistent in 70, and that the function had ceased in 30 only. Again, the table of various ages (p. 688) shows that the largest number of cases occur between thirty and fifty years, during which period this function is active, admitting its cessation about the forty-fifth year as an average.

Unmarried women are said to be more prone to cancer of the breast than the married, and sterile women rather than prolific. The following facts, derived from an examination of a hundred cases, prove the fallacy of such assertions. Thus, of 100 females suffering with cancer, 86 were married, 14 were single. Of the 86 married women 73 were prolific, 4 had aborted, and 9 were sterile. As regards lactation, the writer has failed in establishing any marked relation between the imperfect performance of this function and the subsequent development of cancer. It is a notable fact, especially in relation to diagnosis, that cancer is very rarely developed during pregnancy or suckling.

The primary development is usually observed in the substance of the breast, upon its surface or at its periphery. The patient very frequently accidentally discovers the hardness first by the touch, neither pain nor uneasiness in the part having been experienced. When the growth is seated at the margins of the gland, or upon its surface, it is frequently very movable, circumscribed, and distinct. If, however, lobular infiltration exists, the tumour seems to form an integral portion of the breast, and its isolation from the surrounding structures is impracticable. Diseased gland-tissue and healthy seem to be inseparably blended together. Often if the infiltration involves the central portion of the breast, the whole organ feels merely indurated, and is perhaps unaltered in shape. At this early stage there is usually very slight change in form. Unless the patient be very thin, there is no visible sign of the tumour. We assume, at this time, that its dimensions do not exceed two inches in diameter. The progress of the infiltrating variety of the disease may be wholly confined to the breast throughout the remainder of the life of the patient. In such a case, the gland-tissue having been destroyed by the new growth, contraction takes place; and the disease, where first observed, subsides into a mere rigid inert mass.

If the growth be of the tuberos variety, a circumscribed swelling is discovered in the breast, which at first increases slowly. But here there is always a visible sign of something new being superadded to the bulk of the gland, so that in proportion to the size of the growth the affected breast is just so much in excess of the dimensions of the sound one. This marked disproportion in the comparative sizes of the two glands, in relation to the quantity of new growth in the one diseased, is much more notable in tuberos cancer than in infiltrating. In the early stage, too, the pain in the part is more marked.

Occasionally, at the commencement of the disease, the truly infiltrating form may occur, and during its progress pass into the tuberos. But we do not meet with the opposite condition, at least as regards the gland-tissue. It frequently happens that, during the growth of a tumour or circumscribed mass of cancer, a cyst is formed upon its surface. At least a collection of serous fluid and blood, in relation with the growth, is frequently designated a cyst. In such a case the fluctuation of the fluid is usually distinct.

Another change results from the centre of the new growth softening. Whether this process arises from inflammation or the immediate death of the tissues, we cannot here discuss; but the fact is important on account of the alteration it produces in the palpable signs of the tumour. After feeling solid, perhaps rather elastic, fluctuation is detected, and the Surgeon hopes the case may prove to be one of chronic abscess. Even the visible signs which subsequently arise may favour the delusion; for the skin, becoming thin and red, *almost* assumes the ordinary appearance of the "pointing" of pus. The integuments ulcerate slowly. Several openings sometimes form consecutively. But the discharge is never genuine pus. It is curdy or flaky, blood-tinged, it emits a foetid, perhaps an offensive odour, and a healthy process is not excited. At last, the tumour being removed, a section through its centre shows the new growth, with a cavity in its interior; the walls of the hollow being formed of cancer-tissue, usually varying from a quarter of an inch to three quarters in thickness. The fistulous openings in the skin lead to sinuses communicating with the interior of this growth.

As a rare form of the disease, we must mention that one in which innumerable tubercles are disseminated throughout the substance of the gland; and which, by slowly growing, form larger and larger tubers, until they coalesce into a single mass.

Hitherto we have only described the development of cancer in relation to the breast. But in the progress of the disease all the surrounding structures become involved. Hence there are certain stages of this fearful malady which it is absolutely necessary to describe briefly before alluding to its treatment.

In both kinds of carcinoma, infiltrating and tuberos, the integuments become involved in the disease; but in very different conditions and degrees. In the former, the fat between the gland and the skin becomes absorbed, and the new growth extends along the fibrous septa, infiltrating those structures; and when it has reached the skin, it spreads in that envelope far and wide. The adhesion between the skin and the anterior surface of the breast is very clearly indicated by dimpling or puckering of the integuments over the tumour, and the loss of the natural freedom of movement of the skin upon the gland. Very superficial ulceration next takes place in that part of the skin which has been for some time of a dull red or purplish tint. The ulceration extends deeper and deeper, wider and wider, sometimes leaving a large portion of the breast in a healthy state, whilst it creeps onwards in the surrounding integuments only. Occasionally with merely redness of the skin, sometimes even with scarcely a blush, and in rare cases with an absence of red altogether, the infiltration of the integuments advances, contraction of the infiltrated tissues takes place, and the whole surface of one side of the chest or of both sides is converted into a horny, rigid, unyielding envelope, which entails most acute suffering. Such is the cancer like a cuirass (*en cuirasse*) of the French writers.

In another case, after the skin has become once infiltrated, minute and isolated centres of cancer spring up in the neighbouring integuments, and as they grow, the skin ulcerates, and several detached cutaneous ulcers are developed.

The tuberos variety increases with more or less rapidity, elevating the skin, which becomes thin, its vessels congested, and therefore often of a brilliant hue, shining, and tense. This appearance sometimes closely resembles that of a pointing abscess; but it may be distinguished from it by its slow progress, the little pain accompanying the disease, a more sharply circumscribed redness, and the absence of that gently varying shade of tint from the centre to the periphery of the coloured surface, so characteristic of inflammation. As regards, however, intensity of colour, there is no disease which in this respect at all approaches the brilliant red of some varieties of tubers of carcinoma developed in the skin. The progress of this variety differs remarkably in different cases. The changes which occur are chiefly

due either to morbid processes taking place in the new growth, and destroying it, or to the vitality of the growth being maintained when the disease progresses. Thus, two most opposite conditions result. In one, after the integuments have ulcerated, nearly the whole growth sloughs out; in the other, the tumour continues to grow, and a large fungating mass is formed, which reaches prodigious dimensions in some cases. Accompanying this fungous cancer there is generally a profuse serous secretion, sometimes almost clear, but emitting a sickening, nauseating odour; at other times a sanious, purulent discharge, mixed with the débris of the growth, the effluvium from which is intolerably offensive. Profuse hæmorrhages commonly take place from such growths, from which circumstance William Hey attempted to establish a special variety of cancer.

The above remarks apply to the most common varieties of cancer affecting the breast. Varieties both in appearance, mode of increase, rapidity and slowness of growth, from infiltration of neighbouring tissues, and from accumulations of serum and blood enclosed in cysts, often occur; into a description of which the limits assigned to this essay do not permit us to enter.

Retraction of the nipple occurs in the infiltrating variety of carcinoma; it does not in the tuberos. It is always most marked when the infiltration is central; and sometimes the nipple may be drawn in and towards the hardness when lobular infiltration only exists. This state of the nipple then is pathognomonic only of the variety of the disease, and of the stage at which it has arrived. It should never be regarded as conclusive evidence of the nature of the disease, but merely as an accidental occurrence.

The lymphatic glands in the axilla, above the clavicle, and even those at the side of neck, become infiltrated with cancer as the disease advances. Usually, however, the growth in the breast has been observed some months before they are affected, and generally the integuments are more or less implicated before they are deeply involved. Sometimes the disease, first noticed in the breast, seems to remain quiescent, and the axillary growth advances rapidly. As the morbid condition of the axillary glands advances, the upper extremity becomes oedematous, serous effusion into the pleura of the same side takes place, and the sufferer dies without the primary local disease causing much trouble.

The causes of cancer, and the hereditary influence relating to its generation, are points belonging to the natural history of the disease, which have been already described in the essay on CANCER.

The treatment of cancer of the breast may be carried out upon two principles. The Surgeon has therefore to decide whether the growth shall be allowed to pursue its course under a palliative plan of treatment, or whether the tumour and diseased organ shall be taken off from the body by a cutting operation, or some other method.

There are those who refuse to admit the efficacy of removing a growth of cancer under any circumstances, and there are others who would take it away in every case. A Surgeon who would adopt either the one proceeding or the other exclusively must, we think, err in the treatment of this class of cases. The fact is, we believe, that, in a great number of persons, life may be prolonged, local suffering may be prevented, and much mental anxiety is sure to be avoided, by a careful and judicious selection of those cases in which the removal of the primary growth can be easily effected, and in which the constitutional powers of the patient render a surgical operation admissible.

We may here add, in a very few words, that in every case of the kind the state of the patient's general health is of primary importance. If that be impaired, the doubtful issue of an operation would deter most Surgeons from recommending a proceeding under the influence of which the sufferer might sink; but when, as often happens, the constitution seems to be unaffected, surely that which the Surgeon knows to be a sign, a source, an origin of impending misery, may be taken away with a fair hope of advantage. In

order to point out the cases in which the removal of the cancer is neither desirable nor admissible, we may refer the reader to the lecture of Sir Benjamin Brodie,* and to the essay on CANCER, vol. i. p. 560.

We consider the operation of removing the tumour together with the breast, admissible when the health of the patient appears to be favourable to recovery from that operation, when the disease involves the tissues of the breast only, and when the axillary lymphatic glands are not involved.

We believe it may be undertaken with advantage when the disease has extended to the skin without infiltrating the cutaneous tissue to a wide extent, when ulceration has taken place, and even when the axillary lymphatic glands are distinctly perceptible and somewhat enlarged. As a general rule, it may be stated that the more limited the local disease is at the time of the operation, the better the chance of a satisfactory result as regards the region, and that if the general health of the patient be well attended to, after the wound has healed, some prospect appears of considerably ameliorating the condition of a sufferer affected by this disease.

We cannot here discuss the advantages or disadvantages of a cutting operation, as compared with the removal of the tumour by other methods. Both means have their advocates; both plans may be adopted in special cases. The one is expeditious, attended with little suffering, certain of removing the whole of the diseased organ. The treatment by caustics is tedious, attended generally with excruciating pain, and very uncertain in its operation.

In comparing the results of the two methods upon the constitutional progress or local relapse of the disease, there is not sufficient evidence in favour of any single method. Both are commonly followed by a development of cancer either in the region first affected and its vicinity, or new centres of growth become established in distant parts.

The treatment of ulcerated cancer consists in following out the principles applicable to all sloughing open surfaces; thus, all those applications which tend to cleanse the surface are especially serviceable. Lotions composed of solutions of the chloride of zinc, permanganate of potash, ter-chloride of carbon, chloride of potash, with which sedatives, as morphia, solutions of opium, belladonna, may be combined to soothe the pain, are very useful. Some substances, applied in the form of powder, as equal parts of chloride of zinc and oxide of zinc, or the former mixed with some farinaceous powder or gum, serve very well to induce a more rapid sloughing of the new growth, and a more tolerable state of the ulcerated surface. By persisting in these applications, the wound occasionally even closes, and a tolerably healthy cicatrization of the normal tissues is the result.

The hæmorrhages attending these ulcerated and sloughing surfaces may be controlled by cold, by the application of astringent powders or lotions, and other common styptics. When practicable, the slough from under which the bleeding usually takes place should be removed, in order that the styptic may reach the open vessel.

The cedematous condition of the tissues of the upper extremity, which in some cases ensues upon infiltration of the axillary lymphatic glands, is a source of great suffering, and is very difficult to ameliorate. Local means generally avail little. The elevation of the arm to a limited extent assists the return of the serum.

When a second, a third, or even a fourth or more growths appear, their removal is quite justifiable, provided the constitutional powers of the patient be good, and the local disorder threatens to become a source of prolonged misery and suffering.

The mortality depending upon causes referable to the operation of amputation of the breast is extremely small; the proportion in cases treated in

* *Lectures on various subjects in Pathology and Surgery.*

Guy's Hospital being about six per cent; whilst in private practice it has not amounted to any thing like that figure.

The limits of this essay preclude even touching upon the many points of great interest in the natural history of cancer; but the reader may supply the deficiency by turning to that on CANCER (vol. i.), in which the whole subject of the disease is fully treated of. But I cannot conclude without urging the expediency of removing the *first* growth of cancer in *select* cases. I do so upon the firm conviction, based upon experience, that by so acting life may be prolonged; a certain amount of immunity from bodily suffering and mental distress may be insured; the chance of freedom from all local suffering is given; and that, when unhappily the recurrence of the disease gives rise to ulceration, the duration of that distressing state is shortened.

SPECIAL DISEASES. DIVISION IV.

DISEASES OF THE NIPPLE, AREOLA, SINUSES, AND SEBACEOUS GLANDS.

Deficiency of the nipple. This deformity results from an arrest of its development, or is produced by disease. When, however, a breast exists, there is always a trace of a nipple and areola. There may not be the slightest elevation; even a depression may occupy the site of the mamilla; but the milk-tubes terminate between the rugæ on a small spot of skin. The nipple is often destroyed by disease. Thus gangrene occasionally attacks it, and the whole organ drops off. Also, a nipple once well formed may be drawn inwards or retracted, and so deeply that its extremity is entirely lost to view. But in every case in which a Surgeon observes this condition, especially if associated with disease, he should be scrupulously careful to ascertain if the deformed organ was ever perfectly developed.

A bifid nipple is sometimes seen; and occasionally it is ill-shaped, being clavate, pendulous, and covered with small tubercles. Hypertrophy of its tissues occurs, but rarely. There are cases on record in which several nipples have been developed on one breast (*pleiomastia*).

Inflammation often attacks the nipple. It is especially prone to this condition during the first occasion of suckling, and with some women at the commencement of every lactation. The most frequent result of that morbid condition is the production of superficial ulceration upon its surface. Small ulcers are formed between the rugæ, on its apex and sides, and sometimes they encircle its base, even extending upon the areola. The abraded surfaces are exquisitely painful, and they often bleed freely. Much constitutional disturbance, mental distress, and acute local suffering are excited by these superficial ulcers, which are commonly termed "cracks," "fissures," or "chaps." It is asserted that these ulcers are frequently engendered by the morbid state of the mucous membrane of the infant's mouth. We have not, however, been able to obtain sufficient evidence of the validity of the statement. As regards treatment;—the most essential point towards remedying these troubles consists in frequent ablutions with warm water, and in abstaining from the application of irritating lotions and ointments. A difficulty in most cases arises from the necessity of suckling the infant. Various "shields" are constructed, therefore, to protect the organ from the pressure and dragging caused by the lips and tongue of the infant. The application of soothing substances is preferable to those which produce pain, and therefore a little glycerine, collodion, or almond-oil, is beneficial. Astringent, stimulating, and narcotic applications are not always admissible, on account of the suffering they entail upon the mother, and the risk of injuring the infant. Substances in dry impalpable powder are beneficial. Thus, the oxide of zinc, carbonate of magnesia, lycopodium, prepared chalk, may be tied up in very fine muslin, and the nipple dusted with the particles which pass between the threads. Abscesses, sloughing, herpetic or eczematous eruptions affecting the nipple, require no special mode of treatment.

Hyperæsthesia of the nipple. We have seen a curious condition of the nipple, but only once, to which the term hyperæsthesia seems the most applicable. The organ became, upon exposure, rigid, its follicles very distinct, its base red, and its point bloodless and hence quite white. It was on the person of a middle-aged, married, but sterile woman, who described the pain as most acute.

Inflammation and abscesses, together with various cutaneous eruptions, are developed in the tissues of the areola. Abscess often forms in the portion of the gland immediately beneath it. The point of chief importance to remember, in connection therewith, is that the lacteal sinuses are placed here, and that great care is requisite to avoid cutting them transversely if a bistoury is required to be used. It is always desirable to allow pus to point very prominently when it is formed beneath the areola; and if an incision be made, its direction should always pursue a straight line radiating from the nipple. The effect of departure from these directions may be the division of a duct; the consequence of which will be that, a fistulous opening being established, the milk will flow freely every time the woman suckles, for it rarely heals until after weaning.

Within the area of the nipple and areola new growths are occasionally developed. Pendulous, cutaneous formations; follicular tumours, or cysts, containing sebaceous secretion; vascular growths of true erectile tissue; epithelioma and infiltrating carcinoma, have all been met with in various degrees of frequency: but as they require to be treated upon the same principles as when found in other parts, it would be idle to dwell upon them here.

SPECIAL DISEASES. DIVISION V.

DISEASES OF THE MALE MAMMILLA.

The affections of the male organ relate to its conditions in a perfectly rudimentary state, and when there is a gland developed; for we have seen and dissected as perfect a glandular structure taken from a man as was ever formed in a young girl. Soon after birth the organ becomes tumid, and a secretion forms within the ducts. If left to nature, no difficulty arises. Should inflammation arise, it must be treated as before described.

At puberty the gland usually enlarges, becomes painful for a few days, and then slowly decreases until nothing but the nipple is perceptible. But if the part be irritated, inflammation running on to the formation of abscess will be excited. In rather delicate men the gland is sometimes largely developed,—hypertrophy. This may occur on one side only, or on both sides. The circumstance generally excites annoyance, but no ill result; although the curious may see in pathological museums breasts of this kind which have been removed and labelled “scirrhus.” When these breasts are painful, the improvement of the general health is indicated, and all local pressure must be avoided.

The male is subject to deformities arising from excess of mammillæ: thus we have seen a man with four nipples. We have never met with a case in which there was a deficiency of one or both.

The diseases of this organ in the male are of the same kind as those in the female, already described. But disease very rarely attacks this part in a man. We have seen a sebaceous cyst developed close to the nipple and elevating it, and so closely resembling the bluish-red tint of a tuber of cancer just about to ulcerate, as to excite grave apprehension; but it was excised with the happiest result. Not long since, Mr. Prescott Hewett* removed a cyst and intra-cystic growth from a man's breast.

Carcinoma is the new growth most commonly developed in the male breast. It occurs generally between forty and fifty years of age, either in the infiltrating or tuberos form; generally, however, in the former, extending slowly, and affecting the integuments in its progress. Its treatment is similar to that adopted in the case of a like disease in the female.

JOHN BIRKETT.

* *Lancet*, vol. i. 1864.

DISEASES OF THE THYROID GLAND.

THE thyroid gland, one of the vascular bodies without ducts, consists of two lateral lobes, connected by an isthmus, which crosses in front of the three upper rings of the trachea. Hyrtl affirms that he has met with instances of complete congenital absence of the isthmus; and in aged subjects it is sometimes so far absorbed as to be scarcely distinguishable, the two halves of the gland appearing to be united only by areolar tissue. The proportion of the gland to the entire body diminishes with age. In newborn infants it is 1:300; at the end of the first month it is 1:1200; in adults it falls to 1:1800.* It is supplied by four, and sometimes by five, large arteries, branches of the carotid and subclavian trunks; the fifth artery, when it exists, lying in the mesial line of the trachea. The organ lies, moreover, in close contiguity to the great vessels and nerves of the neck.

Few Surgeons believe that the entire thyroid gland has ever been successfully extirpated, although cases are so related by Desault, Roux, Gooch, Vogel, Theden, Hedenus, and others.

Dr. Hedenus speaks of six successful cases of removal. The operation, as recorded by himself, is as follows: An incision was made from the os hyoides to the top of the sternum, and the skin reflected from each side to the extent of two inches. The sterno-hyoid and thyroid muscles, which were adherent to the tumour, were cut through in consequence of the hæmorrhage following an attempt made to reflect them. He next separated the swelling above and below from the sterno-cleido-mastoid and omohyoid muscles, and also from the jugular vein and carotid artery (to which it was closely adherent), until he freed it as far as the point where the thyroid arteries originate. He then tied the superior and inferior thyroid arteries close to the tumour, and, on account of the free anastomosis, applied to each vessel two ligatures, and divided it in the interspace. The more deeply the dissection now extended, the more hazardous did it appear. Every four or five lines he was obliged to tie two or three arteries; a proceeding which was effected with great difficulty. After most cautiously dissecting to the base of the tumour, which was attached to the thyroid cartilage and the three upper rings of the trachea, he met with so many arteries, for the most part as large as the radial or ulnar, that in order to prevent further loss of blood, he decided to tie the base of the tumour, and to cut away all beyond the ligature. He accordingly first passed a needle, armed with ligatures, through the base of the tumour, and tied the ends; and next passed another ligature round the entire base, and removed as much as he thought proper. Some local applications, of no importance, were applied. During convalescence hæmorrhage occurred, which was arrested by sprinkling the wound with gum-arabic. On the eighth day the ligatures came away. The patient ultimately recovered, and left the

* Hyrtl, *Topog. Anat.* b. i. p. 357.

hospital well !* These proceedings are scarcely considered admissible in modern surgery.

The most frequent affection of the thyroid body is chronic enlargement, or hypertrophy, to which the term "bronchocele" is commonly applied. But under this head are included several morbid changes, allied to one another in being developments of the natural component tissues of the organ.

A simple bronchocele consists in a uniform enlargement of the thyroid body in all its parts. The texture of the gland is healthy, except that it is coarser than that of a thyroid gland of ordinary size. Very frequently numerous cysts of one or two lines in diameter are found filled with a viscid fluid, or some, fewer in number and of larger size, partitioned and filled with a thin watery or bloody fluid, and scattered irregularly through its substance. As the enlargement proceeds, it may surround and compress the trachea and lower part of the larynx. A case is recorded by the late Mr. Howship, in which the jugular vein passed through the substance of the gland, and the patient suffered greatly from congestion of the head. The two lobes are rarely equally increased in size, the right being more commonly the larger: sometimes, it is said, the middle lobe, or isthmus, is principally affected. In this country bronchocele is more common in women than in men. Cases occur in which young girls, from seventeen to twenty-four years of age, are subject to considerable enlargement of the thyroid body at each menstrual period; the swelling subsiding as that function subsides. I had under my care a young lady, in whom this thyroid enlargement became permanent, after the abrupt cessation of menstruation, caused by her being exposed to cold and wet during a stormy passage at sea. Mr. W. W. Cooper has observed that in persons subject to this affection the eyes are often more than usually prominent. When of moderate size, the disease can be easily recognised, both by its position and by its following the movements of the trachea and œsophagus. It rises if the patient be directed to swallow. But when of larger size it may be known as being unlike any thing else. It may be raised with every pulsation of the carotid artery, or hang down in front of the chest, so that it cannot be concealed by any sort of clothing.

In the severer forms bronchocele or goître is endemic. It prevails in Derbyshire, Nottingham, and the chalky parts of England; in the valleys of the Alps, Apennines, and Pyrenees. Postiglione remarks, that in Savoy, Switzerland, the Tyrol, and Carinthia, there are villages in which all the inhabitants,

* Gräfe's *Journal*, b. ii. p. 237.

without exception, have these swellings.* The cause commonly assigned, namely, the use of melted snow, or of water impregnated with calcareous or earthy particles, is unsatisfactory. Capt. Alexander Gerard, in his account of Korrawur, in the Himmalayas, says, "although the Korrawurrees can get nothing but snow for some months in the year, they are not so subject to goître as the people who live in the damp grounds in the forest at the foot of the hills, where there can never be any snow-water. The water which flows from the hills of lias, forming the Asiatic side of the Dardanelles, is impregnated with lime; but yet during a residence of many months I did not notice the prevalence of goître." This idea has been successfully refuted by Alibert; and Foderé has explained how the disease cannot be referred to the use of any particular kind of food. Dr. Guggenbühl, the founder of the Cretin Hospital, remarks that both cretinismus and goître, which may exist either conjointly or separately, prevail in deep valleys, where the air stagnates, and the population, scanty in numbers, becomes deteriorated by frequent inter-marriage. Cases of goître and idiotcy removed to an elevated position, and properly nurtured, are first made to thrive bodily, and then are susceptible of mental improvement; and he particularly relates the case of a cretin child, who, after having passed a life of apparently complete insensibility to external objects, gave suddenly the first indication of aroused consciousness, after proper treatment, by exclaiming, "Die Sonne" (the sun), as the light of day fell on the spot where he was seated. Humboldt says that persons afflicted with bronchocele are met with in the lower course of the Magdalena River, from Honda to the conflux of the Cauca, in the upper part of its course between Neiva and Honda, and on the high country of Bogota, six thousand feet above the bed of the river. The first of these three regions is a thick forest, while the second and third present a soil destitute of vegetation; the first and third are extremely damp, the second is peculiarly dry; in the second and third the winds are impetuous, in the first the air is stagnant. To these striking differences we will add those relative to temperature. In the first and second regions the thermometer keeps up all the year between 71° and 73° F.; in the third it ranges between 37° and 62° F. The waters drunk by the inhabitants of Maraquita, Honda, and Santa Fé de Bogota, where bronchoceles occur, are not those of snow, but issue from rocks of granite, freestone, and lime. The temperature of the waters of Santa Fé and Mompox, drunk by those who have this disease, varies from nine to ten degrees. Bronchoceles are the most hideous at Maraquita, where the springs, which flow over granite, are, according to Humboldt's experiments, chemically more pure than those of Honda or Bogota, and where the climate is much less sultry than upon the banks of the Magdalena River.†

Dr. John Webster has favoured me with some manuscript notes bearing upon this subject. He says, that according to information collected from reliable sources, there are 500,000 goîtreux persons in France. Some localities in that country are very remarkable for the large number so designated. For example, in a town of Lorraine, having recently 736 inhabitants, there were recognised 164 affected with goître, of whom 143 were females. Of the 164 goîtreux, comprising both sexes, 105 lived in houses having a northern exposure, while only 59 inhabited dwellings fronting the south, and thus enjoying more sunshine than the others. At Rosieux, also in Lorraine, it is reported that every indigent female is goîtreuse. In the arrondissement of Schalstadt, situated in the Lower Rhine department, 658 goîtreux were lately registered. A still more remarkable instance of the frequency of the disease occurs at St. Aubin, near Elbœuf, on the banks of the Seine, not far from Rouen, where one female in every 16 of the total population has goître more or less developed. Other places in France might be named where the affection is very prevalent.

* *Memoria sulla Natura del Gozzo*, p. 22.

† Humboldt, in *Journ. de Physiologie*, par F. Majendie, tom. iv. p. 116.

In Piedmont and Savoy, especially the latter, goître is very rife. By an official report, continues Dr. Webster, published a few years ago, there were 18,462 simple goîtreux, besides 3,909 cretins. Various mountainous districts in Europe are afflicted with this complaint, which, however, always disappears before civilisation. It becomes rare as persons are better clothed and fed, and are not compelled to intermarry. Prior to 1818, goître was very common in the Swiss canton of Valais, and particularly in several secluded valleys near Martigny. In that year, from the bursting of a lake high up in the mountains, a valley not far from that town was completely devastated; houses, trees, cattle, and people being carried away by the flood. However frequent in this part was the prevalence of both goître and cretinism before the event, it was remarked that subsequently it nearly entirely disappeared, and the reasons seemed the following. Before the great inundation, the soil of the valley was always wet, marshy, and unproductive. By the overflowing of the lake, a mètre of good vegetable mould was brought down from the higher regions; the natives were obliged to exert themselves in the cultivation, whereby their physical status was much ameliorated, and the supply of food materially augmented.

At Caneles, near the Cordilleras in North Mexico, many of the inhabitants are grievously affected. Authorities state that half of those employed at the mines are goîtreux, though generally only on one side of the neck. It is affirmed that children born of such parents are frequently idiots, or deaf and dumb.

In the treatment of bronchocele we should be particular to put the patient under circumstances favourable to recovery. In females, the menstrual function generally requires regulation; and a low damp situation should, where possible, be changed for a more airy spot. Increase of swelling of the gland, attended with heat and signs of vascular activity, may be controlled by the application of a few leeches. But for the most part local applications are unavailing. Blisters have been applied, and kept open; frictions have been recommended; the application of emplastrum ammoniaci cum hydrargyro, electricity, &c.

The remedy most relied on at the present day is iodine, which was first given in the form of burnt sponge; and is now employed both internally and locally, in the different forms admitted into the pharmacopœia. The iodide of potassium may be administered in doses of two or three grains, even more, three times a day. If more than three grains are given at the commencement, the medicine is removed in its excess by the secretion of the kidneys. In large doses it is apt to excite salivation, and to irritate the stomach. Iodine was discovered in 1813, by Courtois, manufacturer of salt-tre in Paris; but Dr. Coindet was the first to introduce it into medical practice for the cure of bronchocele. Shortly after its efficacy had been established, Dr. Fyfe of Edinburgh discovered the presence of iodine in burnt sponge.

Cases of enlargement of the thyroid body, demanding the application of ligatures to the nutrient arteries, must be considered exceptional; and modern surgery somewhat avoids the operation. In a case recorded by W. Blizard, the patient died from the effects of hospital gangrene;* but a case reported by Walther of Landshut was successful.† The superior thyroid arteries were successfully tied by Mr. Coates of Salisbury.‡ Mr. Key observes,§ “while on the subject of tying arteries in the region of the neck, I have referred to the operation of tying the superior thyroid artery as performed by Sir W. Blizard, by Mr. Earle, and others. It is an operation

* Burns, *Surgical Anatomy of the Head and Neck*, p. 202.

† *Nouv. Heilart des Kropfes*, p. 25; 1817.

‡ *Med. and Chir. Trans.* vol. x. p. 312.

§ *Operative Surgery*, p. 545; see edit. 1858.

the performance of which is perfectly justifiable, and, as I can testify, is attended with marked diminution of the enlarged structure, if this be the object to be attained: but the relations of the inferior thyroid arteries are so much more complicated, and the artery itself lies so deeply imbedded in the structures of the neck, that I conceive its exposure without danger to be almost impossible." Thus the question stands; the general feeling being by no means favourable towards the operation.

Dr. Murnay speaks highly of the treatment of bronchocele by strychnia. The first case in which he used it was that of a lady æt. 30, who had had good health up to four years previously, when the catamenia became irregular and were attended with great pain on each periodic return. She assigned as the cause of the thyroid tumour great distress of mind and disappointment. When Dr. Murnay saw her, the disease was of six months' duration; the right lobe of the thyroid gland was fully as big as a turkey's egg, extending laterally so as to press on the right carotid artery and jugular vein; a strong pulsation was felt in the tumour, and a purring thrill was communicated to the hand. She had no palpitation of the heart; but she complained of headache, and of a buzzing noise in the right ear; she imagined there was a slight enlargement of the right eye, and that she felt a sensation of fulness in it. The tumour at times impeded deglutition, and occasionally her breathing also. After a fair trial of the usual remedies, strychnia was administered in the dose of $\frac{1}{16}$ gr. three times a-day. At the end of a fortnight there was great improvement, and ultimately the gland regained its normal size. The second case was that of a housemaid, the enlargement having lasted twelve months, and both lobes being involved. There was great palpitation of the heart, pulse 130, eyes prominent, catamenia irregular, tongue large and flabby, and coated with a yellow fur in the centre; bowels constipated, acting only once a-week. In this case the medicine was ordered in a fluid form; one grain was dissolved in seven drachms of water, and one of dilute sulphuric acid. She was to commence with five minims three times a-day, and to increase to twenty. On the tenth day of taking the medicine, a great flow of menstrual discharge came on, lasted a few days, and returned in a week. The treatment was continued, and soon after the gland began to shrink. The third case was that of a young lady aged 15, in which at the time of the report the symptoms were progressing favourably.

Mr. Hey, of York, has treated bronchocele successfully by seton. The patient was a young lady 21 years of age, who had suffered from bronchocele from her earliest infancy. Mr. Hey passed a skein of silk through one half of the gland, commencing at the upper part, in the median line, and taking as nearly as possible a semicircular direction, brought it out at the corresponding point below; thus embracing half the tumour, at a depth of from three-quarters to one inch, so that the seton was fairly established in the substance of the gland. The patient did not seem to suffer pain, and there was no hæmorrhage of consequence. For the first five weeks no material change took place; the discharge was slight, and it was found necessary to use saving ointment. In the course of the sixth week the patient suffered from a feverish attack; on the third or fourth night after the fever, she was seized with a cough of most distressing character; she became delirious, with brown and dry tongue; this condition lasted forty-eight hours. The seton began to discharge a thin, dirty-looking, and most offensive matter which relieved the irritation about the windpipe, and the delirium subsided. By degrees the discharge became purulent, and ultimately all signs of thyroid enlargement disappeared.† Mr. Hey remarks, that this operation was known a century ago; but Dr. Quadri of Naples revived it, and practised it to a considerable extent about the years 1817-18. Mr. Copland Hutchinson tried

* *Dublin Hosp. Gaz.* June 1, 1860.

† *Provincial Medical and Surgical Journal*, Sept. 10, 1849.

it in 1819.* Mr. T. A. Thompson and others have followed, with generally favourable results. Still the nature of the symptoms here recorded point clearly to chances of risk, and a cautious practitioner should well weigh the necessity of operating at all.

M. E. Collin, médecin-major de 1^{re} classe, records the particulars of a remarkable attack of acute goitre in the garrison at Briançon during the year 1860. The 87th regiment of the line arrived at Briançon on the 22d of October 1859. During 1860 it represented the garrison of the place, comprising an effective force of 1062 men. During the year the regiment sent to the infirmary 55 cases of goitre. Of these 55, there were 53 acute cases contracted at the town. The attack nearly always commenced after six months' residence. The five months most fertile in the generation of goitre were from May to September. M. Collin has called attention several times to the rapidity with which this disease may manifest itself. In certain subjects much predisposed, eight days sufficed for its formation.

Of the 53 goîtres, there were 8 median, 2 unilateral, 27 bilateral, and 16 three-lobed. Of the 27 bilateral goîtres, 20 were on the right side; and of the 16 three-lobed, 10 were also on the right. This latter point confirms the opinion of Alibert, and is supported by nearly all the specimens in the Hunterian Museum. No remedies were found of any avail; and M. Collin very properly recommended either a rapid change in the regiment, or an entire change in the locality of the station. He adds that during winter the ground is constantly covered with snow; and that during that season there is no proper place for exercise.†

Instances are upon record in which bronchocele has proved fatal by compression of the trachea. One of the latest cases is recorded by Dr. Dickinson.‡ The patient was a tailor aged seventeen; for some time he had had palpitation of the heart, and about eighteen months before his death, he noticed a swelling in the position of the isthmus of the thyroid gland. The swelling extended laterally, so as to occupy the sides of the neck, and he then began to have fits of shortness of breath. In the attacks of dyspnoea the air passed with a hissing sound, as if from constriction of the larynx. He was admitted into St. George's Hospital, where he one night died suffocated, before tracheotomy could be performed. Upon examination after death, it was found that the compression of the trachea, which was very great, commenced at about two inches below the vocal chords, and extended downwards for two or three inches. A preparation, exhibiting in a striking manner the enlarged thyroid gland surrounding and compressing the trachea and the lower part of the larynx, is preserved in the Museum of St. Bartholomew's Hospital. Mr. Macwhinnie§ relates the case of a patient aged seventeen, attended by Mr. M'Crea of Islington, where death ensued under symptoms similar to those of strangulation.

The enlargement of the thyroid gland, which has been noticed not uncommonly in pregnancy, and quite independently of the conditions usually considered to be favourable to the production of goitre, is not usually dangerous; but M. Guillot notices two cases under his own care, which show that it may prove perilous to life itself. A lady æt. thirty, in easy circumstances and of excellent health and constitution, found her neck, during a first pregnancy, become the seat of a slowly-increasing enlargement. During a second pregnancy, in 1835, it increased again and became troublesome. In 1858 M. Guillot saw her with M. Trousseau, as the respiration was much impeded. A few days afterwards, the patient being nearly asphyxiated, laryngotomy was performed with immediate relief, but death ensued in two days.

* *Med.-Chir. Trans.* vol. xi. p. 235.

† *Recueil des Mémoires de Méd. Militaire*, juillet 1861.

‡ *Trans. of Path. Society of London*, vol. xii. p. 229.

§ *Lancet*, July 13, 1861.

The second case was that of a young woman aged twenty-nine, the mother of two children. Both respiration and voice were embarrassed, and she was liable to suffocative paroxysms. These symptoms had come on gradually from the time of her first pregnancy. She was admitted into the Necker Hospital, where one of the paroxysms of dyspnoea terminated fatally. The thyroid gland had nearly acquired the size of a human brain; the tissue was healthy in appearance, and there were numerous small cysts scattered throughout its substance.* The author regards the disease as one of the manifestations of the excessive production of fibrine during pregnancy.

Dr. Herbert Davies exhibited at the Pathological Society of London, May 21, 1849, both the thyroid and the thymus glands much hypertrophied, taken from a boy aged sixteen, who died suddenly from a spasmodic affection of the larynx. He had noticed the swelling of the neck about the age of fifteen; the enlargement increased rapidly about four months previous to his death, and it produced a sensation as if he were "breathing through a sponge." On examination, the thyroid, thymus, and bronchial glands were found much enlarged; in the last there was a deposit of tubercle. On microscopic examination of the thyroid gland, it was found to consist of the usual vesicles containing a fluid in which were a large number of corpuscles, the majority of which were smaller than the blood-discs.

Pulsating or exophthalmic bronchocele. A peculiar variety of bronchocele, distinct from the ordinary goitre, and to which various names have been applied, may be here noticed; though, as it forms but one link in a long chain of morbid symptoms, it would be out of place to describe fully the disease, of which it forms but a part, among the affections of the thyroid gland. It is almost invariably associated with palpitation of the heart and a prominent condition of the eyeballs, and hence have arisen the various names under which these combined symptoms have been described: as "goitre exophthalmique," "affection of the heart and thyroid gland," "anæmic exophthalmos," "maladie de Graves," "maladie de Brasedow,"—according to the theory of the origin of the disease which each writer adopts, or the name of the authors who were supposed to have first described it. It occurs more commonly in females than in males, though it is by no means confined to the former sex. The characters of the disease are very well marked, and are thus enumerated. The first symptoms are usually palpitation of the heart and habitually rapid pulse, with other signs of nervous debility; and these are followed at a longer or shorter interval by enlargement and pulsation of the thyroid gland, with violent beatings of the carotid arteries. After these symptoms have existed for some time,—and in some cases, it is said, before the enlargement of the thyroid gland,—an unnatural prominence of the eyeballs begins to be perceptible; and this gives to the patient a wild or startled, and occasionally almost maniacal expression. In a case related by Dr. Stokes,† "the tumefaction continued to increase, until the globes of the eyes appeared to protrude from the orbits, looking downwards and forwards, and exhibiting a zone of white sclerotic round the entire of the cornea of at least two lines in breadth. The lids could only be half closed; and the appearance of this lady during sleep, with these great brilliant eyes yet open, can never be effaced from my memory."‡

* *Archiv. Gén. de Méd.* t. xvi. 1860.

† *Diseases of the Heart and Aorta*, 1854, p. 285.

‡ Dr. Stokes supposes that the prominence of the eyeballs depends on an increase in the vitreous and aqueous humours; but the majority of observers, probably more correctly, think that the prominence is caused by some morbid condition of the structures situated in the orbit, behind the globe. What this morbid state is, remains, however, still uncertain. Effusion of serum, increase of post-ocular fat and cellular tissue, congestion of the orbital veins, &c. have been assigned by different writers as causes of the protrusion.

The enlargement of the thyroid gland is peculiar. In one of Dr. Begbie's cases, which may be taken as a type, it was soft, smooth, and elastic, and of equal character throughout, presenting the form of hypertrophied gland, and had rapidly developed itself to its present size—that of three or four times the magnitude of the gland in health; but it was subject to remarkable variations in this respect, according to the state of mind, rest, or palpitation. It appeared to be highly vascular, and conveyed to the touch the sensation of an erectile tumour.* There is commonly also a purring thrill to be felt by the fingers, and a loud and sometimes musical bruit to be heard through the stethoscope. Indeed, some years ago a case, in which there existed this condition of the gland, was mistaken for an aneurism, and (though fortunately for the patient the nature of the disease was discovered in time) a day had been appointed for tying the carotid artery.†

Together with the pulsation of the thyroid gland and of its dilated main arteries, the carotids beat violently, and often with a double pulsation and loud bruit; and the patient complains of distressing sensations of suffocation, hammering in the head, vertigo, tinnitus aurium, &c. In a case recorded by Sir H. Marsh, the patient could feel the whizzing in her neck, and it formed one of her most distressing symptoms. Sometimes also the pulse in other arteries than the carotid is unusually jerking and large. In one of Dr. Stokes' cases the patient complained of violent pulsation of the abdominal aorta; and in a case which Dr. C. J. B. Williams mentioned at the Med.-Chir. Society,‡ there was enlargement of the arteries of the forehead, face, and neck. In many cases, however, a marked difference in the pulsation of the carotids and of the radial arteries has been noticed; that of the former being violent and jerking, that of the latter comparatively feeble.§ Sometimes large veins can be seen ramifying over the enlarged thyroid gland; and the external jugular and other veins of the neck are at the same time much distended. The heart beats quickly, and upon the least excitement violently; and at its base and in the large arteries a bellows-sound is almost always to be heard through a stethoscope. The pulse, indeed, habitually rapid, often reaches 130-140 beats in a minute.||

From the foregoing account it will be readily seen that this disease is very different from ordinary goitre; and indeed its diagnosis from this or from any other malady is not difficult. These are the chief points of distinction from common bronchiocele: 1. The size of the tumour formed by the enlarged gland varies considerably with the general condition of the patient as to rest or excitement, and their effect on the heart's action; 2. the appearance of the disease is independent of endemic influences, so powerful in the production of ordinary goitre; 3. the tumour rarely becomes large enough to cause any great deformity, though Dr. Stokes says he has seen two cases in which this was produced in a considerable degree; 4. Dr. Graves says that it differs also from goitre in its size becoming stationary just at that period of growth at which the last-named disease usually increases more rapidly; 5. the purring thrill and loud murmur in the tumour, as well as the other general symptoms,—the palpitation, the prominent eyeballs, the jerking carotids, &c.,—will be abundantly sufficient for confirming the diagnosis.

Notwithstanding the apparent urgency of the symptoms, this disease is very rarely fatal, unless accompanied with organic disease of the heart, or some other serious complication. Comparatively few opportunities of examining the condition of the thyroid gland, after death, have therefore occurred;

* *Contributions to Practical Medicine*, 1862, p. 121.

† *Diseases of the Heart and Aorta*, by Dr. Stokes, p. 279.

‡ *Lancet*, Dec. 8, 1860.

§ Dr. Stokes, op. cit.; Dr. J. O. Fletcher, *Brit. Med. Journal*, May 23, 1863.

|| Begbie, op. cit. p. 130.

and these have been for the most part in those who died from some attendant malady, rather than from the peculiar assemblage of morbid symptoms which by themselves make up the disease.

The appearances, therefore, which have been observed in the heart, &c. after death, in the few cases on record, must not be taken as representing those which ordinarily exist; but must be checked by the observation of the far larger number of cases in which complete recovery has ensued on proper treatment. The appearances, however, which more immediately concern us—those in the thyroid gland, namely—are probably characteristic.

In 1841, Sir H. Marsh communicated to the Pathological Society of Dublin an account of a patient who suffered from this disease, and who died from gangrene of the extremities, preceded by erysipelas and anasarca. The thyroid gland was irregularly lobulated on the surface, the lobules or cysts containing a quantity of clear fluid. The right internal jugular vein was much dilated, and measured, when emptied by puncture, an inch and a half across. One of the enlarged lobes of the thyroid body lay over the carotid artery. Both auricles, especially the left, were much dilated. The left ventricle was somewhat dilated and hypertrophied. The auriculo-ventricular valves, on both sides, had thickened margins; the disease apparently proceeding from depositions of fatty granular matter under the membrane. The right valves were more affected than the left.* In another case, that of a woman who died from apoplexy, and who, at the time of her death, suffered from this disease, the thyroid arteries, which during life could be felt pulsating strongly, were found greatly enlarged and remarkably tortuous. The thyroid gland was enlarged. The left ventricle was greatly hypertrophied, and its cavity much dilated.† In a case of Dr. Begbie's, the thyroid gland was enlarged to three times its normal bulk from hypertrophy. The heart was somewhat enlarged, from slight dilatation of the right cavities. The walls of the right auricle were very thin. The valves were healthy. Various other organs were more or less diseased.‡ In another case recorded by the same author, and in which the patient died from heart-disease, general dropsy, &c. "the sterno-hyoid and sterno-thyroid muscles were much thinner and broader than natural, from being stretched over the thyroid body, which was of large size. The external jugular veins were normal; the internal jugulars were large; the left one, when slit open, measured an inch and a half across at a level with the cricoid cartilage. The thyroid body was of large size, but was not weighed; its weight, however, might be computed at four or five times the natural weight. Each lateral lobe measured an inch and a half in breadth, and was of a corresponding thickness. This great size was not partial, but general; and although the isthmus was comparatively larger than the lateral lobes, there was complete symmetry of both sides. It was of a dusky-red colour, smooth, and well-defined, and slightly irregular on its anterior surface; but still retained the natural convex and semilunar form of the organ when in a state of health.§ Several other organs were diseased. The prognosis in those cases—the most frequent—in which there exist no signs of grave organic disease in the heart or other organs is very favourable, though a long time often passes before the characteristic features of the disease entirely disappear. In favourable cases, the heart, becoming less excitable, again recovers its former steady and healthy action; and an improvement in the state of this organ seems to be usually the first step towards recovery.|| Then follow recession of the eyeballs within the orbit, and gradual lessening of the thyroid tumour, with loss of its pulsation, and, it may be, hardening of its substance;¶ and accompanying these are improvement in general health, and commonly, after a longer or shorter time, perfect recovery.

* Stokes, op. cit. p. 290.

† Ibid. p. 291.

‡ Op. cit. p. 141.

§ Op. cit. p. 146.

|| Dr. Fletcher, Dr. Stokes, &c. op. cit.

¶ Dr. Bullar, *Med.-Chir. Trans.* vol. xlv. p. 40; Dr. Stokes, op. cit. p. 288.

The immediate causes of the disease are not very well defined ; but they appear to include almost any of those circumstances which lead to general ill-health and anæmia, although in some cases the patients are tolerably healthy-looking or even plethoric. Dr. Begbie, however, thinks that even in these there is probably an unhealthy condition of the blood ; and adds, "I have seen no instance of the disease in which the general and physical signs of anæmia were not more or less completely developed, and no case in which an adequate cause of that condition was not furnished in its history ; nor any one in which a marked mitigation, or complete removal of the symptoms, has not taken place under a plan of treatment calculated to overcome the blood-disorder."* Amenorrhœa, long-continued hæmorrhage from piles, bilious diarrhœa, want of rest, and many other similar causes, have been assigned in different cases. Dr. Stokes says, "In young women, mental anxiety and the effect of terror may produce it. I have known a remarkable instance of the latter cause inducing the disease in a lady who had previously been healthy." In a few cases the disease appears intimately associated with organic disease of the heart ; but this can be by no means considered essential, and the cardiac disease is supposed by many, when it exists, to follow rather than precede the symptoms which have been described, and to arise from long-continued functional disorder of the organ.

There has been almost as much difference of opinion concerning the nature of this disease as there has been agreement concerning its symptoms, prognosis, and treatment. Dr. Begbie thinks that the essence of the disease consists in a vitiated or impoverished condition of the blood, and that this condition, acting directly on the cardiac nerves, excites the heart and vessels to over-action ; that the anæmic palpitation thus produced is followed by the characteristic symptoms, and, if not removed, issues in organic change of the heart, in enlargement of the great vessels, in induration and structural degeneration of the thyroid gland, &c. Dr. Stokes supposes that the disease is a special form of cardiac neurosis, which may lead to organic disease, and that the nervous excitement is possibly propagated to the arteries of the neck, as he thinks that their pulsation is more than can be accounted for by the force of the heart. Prof. Laycock† thinks the symptoms are due to neurosis of the cerebro-spinal tract, or rather of several vaso-motor centres in the spinal cord. The bronchocele (which is essentially a dilatation of the vessels of the thyroid gland) he thinks is due to a lesion of a paralysing kind of the trunk of the sympathetic. Dr. J. O. Fletcher is of opinion that we must look to the nervous system, and especially to the brain for the cause, and that the disease is 'hyperneuria,' induced by sleeplessness, anxiety, &c. impairing digestion and assimilation ; "secondarily interfering with the normal nutrition of the nerve-centres, causing a state of hyperneurosis with want of power, which induces imperfect secretion by some organs, and as a necessary consequence of this, if long continued, causes organic changes."‡ Dr. Handfield Jones:§ that the fundamental malady is debility, especially of the nervous system, which by affecting various vaso-motor nerves gives rise to the several symptoms.¶ M. Trousseau : that it is a neurosis, having its proximate cause in a change of the vaso-motor apparatus, and that the anæmia follows, rather than precedes, the characteristic symptoms.||

The proper treatment is very definitely pointed out by the causes and symptoms of the disease. To remove those conditions (if they still exist) which appear to have been important elements in the first production of the disease, as hæmorrhage, over-exertion of mind or body, &c.—to allay the excessive action and irritability of the heart by digitalis, morphia, hyoscyamus, and similar drugs—to improve the impoverished or vitiated blood by tonics, especially iron—to place the patient in favourable conditions,

* Op. cit. p. 170.

† *Brit. and For. Med.-Chir. Rev.* Jan. 1864.

‡ Op. cit. p. 532.

§ *Proceedings of Med.-Chir. Soc.* 1861.

|| *Clinique Méd. de l'Hôtel Dieu*, pp. 644, 645.

so far as is possible, for good air and perfect rest,—are the obvious and most important general methods of treatment, the details of which must be decided separately for each case. Iodine, whether taken internally, or applied to the surface of the swollen thyroid gland, appears to be by itself of very little use. The application of ice appears in some cases to be very beneficial. It does not often happen that immediate danger is caused by the pressure of the enlarged thyroid body on the trachea; but M. Trousseau relates such a case; and the patient, a boy about 14 years old, was apparently saved from suffocation, or, at least, from undergoing tracheotomy, by venæsection, by the application of ice to the neck, and by the administration internally of digitalis.* Three weeks afterwards he could walk more than two miles, and, when M. Trousseau last saw him, he had almost completely recovered.

Dr. Graves ingeniously suggests that the globus hystericus, so commonly attendant upon nervous palpitation, and so often referred by the patient to the situation of the thyroid gland, may arise from swelling of this body and pressure on the trachea; and that it is not, therefore, a purely nervous sensation.

Acute inflammation of the thyroid body is rare. Dr. Watson remarks that this gland “does not seem very prone to inflame; and probably Dr. Copland is right in his opinion that inflammation occurs spontaneously in this organ in scrofulous persons only.”† I have met with one instance of the disease. An old woman, incurably insane, died in Bethlehem Hospital, December 22, 1846. Before death, for some days, she had experienced great difficulty in swallowing, and had objected to take food. On examination of the body, it was found that the skull-cap was thicker and heavier than natural, and the brain was congested with blood. There was diffused purulent infiltration, for one inch in length and half an inch in breadth, affecting the cellular tissue of the œsophagus just where it winds round to get in front of the descending aorta. The left lobe of the thyroid body was much enlarged, and occupied by cysts of various sizes. There was purulent infiltration diffused throughout the whole organ, but more extensive on the left side. The cysts contained flakes of thick fibrine mixed with foetid fluid. The œsophagus was contracted in that spot around which the pus had been effused. There was no other morbid appearance.

Mr. Turner, of Kensington, has related some cases of suppurating cysts of the thyroid body, treated by free incision; in one case the cyst-wall came away, and, reasoning from this experience, he proposed, as a method of treatment, to obliterate the cysts formed in this gland by inflammation artificially excited in the following manner. The skin covering the cysts was gradually destroyed by repeated applications of caustic potash rubbed over a space equal in size to a florin; then a blunt-pointed director was introduced, and pushed about so as to excite vascular action, in consequence of which suppuration ensued, and the cavity slowly contracted. He put this method

* Op. cit. p. 631.

† *Lect. Practice of Physic*, vol. i. p. 756, 1845.

into practice in two cases, the particulars of which are related in the *Medical Times and Gazette*, Jan. 20, 1855. But, while according merit to this Surgeon for the care with which he conducted his cases, we must not be unmindful of the danger likely to ensue from these proceedings. In 1841, the late Mr. Vincent had under his care, in St. Bartholomew's Hospital, a woman, 48 years old, with a tumour in front of the neck as large as the head of a child of two years. The tumour contained fluid, which was twice withdrawn with a trocar. The fluid first evacuated resembled serum, but coagulated spontaneously; on the second occasion it was mixed with blood. After the second operation, the cyst inflamed, and discharged grumous and sanious pus; but it also enlarged quickly, and the patient died unexpectedly from suffocation. On examination after death, it was found that nearly the whole of the right lobe of the thyroid body was occupied by a cyst, the walls of which were two lines in thickness; the cavity was full of lymph, pus, and blood; the sudden death was due to a discharge of a great part of its contents into the pharynx and larynx, through an ulcerated aperture into the former.* In reference to this subject Flajani says: "I was once called to assist a gentleman, 40 years of age, brought to death's door by a bleeding, which arose from the application of caustic to the fore part of the neck. As tourniquets, bandages, &c. proved quite ineffectual, it was indispensable to make pressure on the part with the finger of an assistant for twenty-four hours, ere the hæmorrhage could be stopped; a copious suppuration ensued, and it was three months before the part healed. I was likewise present," says he, "at the opening of a similar but larger swelling in the same situation, the patient being an elderly person, who had suffered from the disease for several years. The incision caused the evacuation of a small quantity of serum, contained in the cellular membrane; but the following day the tumour inflamed, the difficulty of respiration increased, and for some days the patient was in great danger. At length suppuration was established, followed by destruction of a great deal of the cellular membrane and several sinuses. The patient lost his life; and on examination of the body, the lungs were found tuberculated; an effect of the impediment to the circulation of the blood through the smaller vessels of those organs."†

I have succeeded in producing the complete obliteration of a thyroid cyst, with corresponding diminution in the size of the swelling of the gland, in a young married woman, healthy, and of temperate habits, by means of the injection of iodine in the usual proportions of one drachm of the tincture to five of water. But whoever undertakes such an operation should bear in mind the numerous complications which may await him; as well as the fact that in some instances the hæmorrhage has been so severe as to demand the application of a ligature to the carotid artery.

Two cases of cancer of the thyroid body have been recorded by Dr. v. Franque.‡ Both patients were between 40 and 50 years of age, and in both instances there was found further morbid deposit in various organs. In the left lung of the first case there were noticed old tubercle in the upper lobe, and cancerous deposit in the other parts. In the second case the viscera were very generally affected.

The same disease has been described by Mr. Cæsar Hawkins in the *Medical Gazette*, 1843. The first case, seen in 1837, might perhaps be somewhat doubtful from want of post-mortem examination; but four other cases were verified.

* Museum of St. Bartholomew's Hospital, ser. xxii. no. 16.

† Flajani, *Collezione d' Osserv.* t. iii. p. 283, 8vo, Roma, 1802.

‡ *Deutsche Klin.* vol. xxxix. 1856.

The disease commenced between the ages of 45 and 60. In one instance the parts adjacent to the pharynx and œsophagus were infiltrated by cancer. There was a large ulcer on the œsophagus, and the right internal jugular vein was closely adherent to the tumour. I have seen a similar case in St. Bartholomew's Hospital.

In such cases none but palliative remedies are of any avail; but the pain and distress in breathing may be greatly allayed by the employment of the hypodermic injection of morphine.

In conclusion, I may repeat the words of Rokitansky: "If we except serous, fibrous, cartilaginous, and bone-like productions, all other new formations in the thyroid gland are extremely rare. Tubercle is scarcely ever seen, and cancer in its medullary form is in the highest degree exceptional."*

HOLMES COOTE.

* *Pathol. Anat.* vol. iii. p. 151.

DISEASES OF THE SKIN.

PART I. GENERAL OR CONSTITUTIONAL AFFECTIONS.

EVERY deviation from the healthy structure, function, or colour of any one anatomical element of the skin is a disease of the skin; and all abnormal states of the hair and nails are properly ranked in the same category, because the hair is formed by one of the integral parts of the skin, and the nails are a modification of the epithelium.

The majority of the diseases of the skin are secondary to constitutional derangements; in some, however, the latter are comparatively trifling, while in others the external local disease is an insignificant part of a grave illness. Special writers have usually classed some of these grave constitutional diseases among diseases of the skin; but at any rate it seems undesirable to describe under this head the acute specific diseases.

In other diseases of the skin, again, the subcutaneous tissues are so deeply involved, that the skin-affection constitutes a very small part of the local disease, and the propriety of classing such affections with ordinary skin-diseases is more than questionable. The same is true in regard of certain diseases attended with deviations from the healthy functions of the skin; as for example, local perspiration, the result of disease of the nervous system.

Diseases of the skin are often treated of as special affections; but diseases of the skin no more constitute a special department of medicine than do diseases of the heart, lungs, or liver. Like diseases of all other organs, diseases of the skin are disposed to by certain constitutional states, and by diseases of other parts; and like all other organs, the skin, when extensively diseased, leads, perhaps through the medium of the blood, to abnormal conditions of parts not anatomically related to it. Diseases of the skin do not differ essentially from diseases of other organs: they owe their origin to the same kind of causes, they agree with them pathologically, they run a similar course, and they have like terminations. In regard of general pathology, of general etiology, and of general therapeutics, diseases of the skin are by no means special. In reference to the majority of diseases of the skin, as in reference to other diseases, we have to consider the constitutional state that disposes to the affection, the local condition that renders the skin susceptible of the special disease, and the locally-acting cause which determines the occurrence of the disease; and each of these subjects requires to be kept in view when treating the disease, and when (a point of great moment in reference to diseases of the external surface of the body) determining the proper measures to be adopted in order to prevent a recurrence of the disease.

The division of diseases of the skin into genera and species, and the best modes of grouping these in classes, have occupied a great deal of the attention of dermatologists.

No doubt, theoretically considered, the best and primary division of diseases of the skin is into essentially local diseases and essentially constitutional diseases. And this division would be practically the best, if all diseases of the skin could be arranged under the one or the other head; because, by the position assigned to any particular disease, its most important pathological character would then be at once known, and also the most important point to be kept in view in its treatment. But this arrangement is impracticable. Our knowledge of diseases of the skin is not precise enough for all to be referred severally to the one or the other of these heads.

Itch is essentially a local disease, and small-pox a constitutional affection; but where shall miliaria be placed, seeing that the miliary eruption is excited by some abnormal conditions of the perspiration, *e. g.* such as occurs in rheumatism? Again, where shall urticaria be grouped? Urticaria is sometimes excited by certain articles of diet; that is to say, during the digestion of these articles a material enters the blood, or the blood is so modified as to excite the disease of the skin called urticaria. Now, does the fact of the blood being contaminated in this way from the food constitute a claim for urticaria to be ranked as a constitutional affection? It manifestly does so. But then the application of certain irritants to the skin produces a disease identical anatomically with that induced by the ingestion of the substances just adverted to. So that urticaria may be a purely local affection, or merely the local manifestation of a constitutional state. The inconvenience of separating two cases of what is one genus when considered anatomically, is manifest. If the diseases of the skin of parasitic origin, and those induced by the external application of direct irritants, be excluded, there are very few which are not more or less dependent on constitutional derangement. Even parasitic diseases seem to take little hold on the constitutionally sound; and many of those primarily excited by local irritants are kept up by constitutional abnormalities.

A second method of dividing skin-diseases into orders is founded on the supposed pathological nature of the local affection, *e. g.* inflammation, hypertrophy, the orders thus formed being divided into genera according to the structure supposed to be first affected, *e. g.* the sudoriferous ducts, the sebaceous follicles, the hair-follicles, the epithelium. But the fact is, that medical knowledge is not yet sufficiently advanced to enable us to determine in the majority of cases either the primary pathological process or the part of the skin, anatomically considered, first affected. So that this division, which when first proposed to us charms by its appearance of scientific accuracy, is in the present state of medicine practically impossible. The time may come when it will be as useful as it is theoretically pleasing, but to-day is not that time.

A third division of skin-diseases, and that which will be adopted in this article, is substantially that originally proposed by Plenck of Baden, and adopted with some modification by Willan, and subsequently employed by a large number of writers on the subject. At the same time I shall deviate from Willan's arrangement widely in one or two important particulars. The microscope, by revealing the presence of parasitic plants in certain of the diseases of the skin, and the close study of these same diseases, by which the relation between the plant and the disease has been ascertained, enable us to found a new order, and so, by abstracting certain diseases from some of the genera of Willan, to render those genera infinitely more natural.

The faults in principle of Willan's arrangement are many and obvious; but then it is eminently practical. The diseases grouped together in his arrangement by no means agree pathologically; but then his divisions greatly facilitate diagnosis; they enable the name of a particular case of disease to be learned, and that being learned, its pathological and anatomical position may subsequently be determined.

Exanthemata. The diseases of the first group have, as their great characteristic, redness, disappearing or diminishing transiently on pressure. The cutaneous affection is essentially nothing more than an increased quantity of blood in the vessels of a portion of the skin: no vesicles, no pustules, no scales, no elevation of the cutis are present. Now and then, however, the blood accumulates in such quantity at particular points as to cause a little elevation of the cutis; and if these points are small and circular, we have an appearance of papulæ; but the elevation, like the redness, disappears on pressure; to return, however, when the pressure is removed. True papulæ cannot be removed for an instant by pressure.

The connection between the hyperæmic cutis and the cuticle covering it is

usually diminished either before or during the stage of resolution; and the consequence is, that there is generally a little desquamation of the cuticle while the rash is fading, or after the redness has disappeared. It is highly probable that the loosening of the cuticle is due to the effusion of a small quantity of serosity from the engorged vessels of the surface of the cutis. Now and then fluid is effused in sufficient quantity to raise the cuticle from the cutis: thus in the eruption of scarlet fever it is very common to find innumerable vesicles stud the red surface; and in erysipelas the cuticle is occasionally elevated into bullæ. The diseases characterised by red patches disappearing under pressure constitute the order exanthemata: these diseases are erythema, roseola, urticaria.

Hæmorrhagia. In the exanthemata the blood is within the vessels of the red part; in the order hæmorrhagia the blood escapes from its vessels into the substance of the cutis, and so crimson spots unaffected by pressure are formed. There are only two diseases thus distinguished, viz. purpura and scorvy. But hæmorrhage into the substance of the cutis occurs, and not uncommonly in the course of all diseases of low type. If the hæmorrhagic spots be small, they are termed petechiæ; if large, vibices or ecchymoses. When small, the spots formed by cuticular hæmorrhage are usually circular; at the bend of the elbow, however, they are oval. When large, they are often very irregular in form.

Vesiculæ. The third group is characterised by vesicles, *i. e.* by minute collections of serous fluid seated immediately under the cuticle. Although at first transparent, this fluid ordinarily becomes in a short time opalescent, milky, or even puriform. The cuticle covering it is also at first quite transparent; after a while, however, it, like the fluid beneath, grows white and opaque. This change in the cuticle may precede that in the contents of the vesicle. The fluid of a vesicle is formed on the surface of the cutis, directly beneath the cuticle. The fluid from a vesicle may be absorbed, or it may dry up and form with the cuticle over it a thin scale; this scale may be detached, or it may remain attached and be thickened by fresh secretion beneath it.

If the vesicles are very small and numerous, and the fluid in them contains but little solid matter, then a mere furfuraceous desquamation follows the absorption of their contents, their bursting, or their desiccation; under these circumstances the vesicular nature of the disease may be overlooked, and the desquamation of the cuticle only noticed.

If the fluid contains a large amount of solid matters, or if the scales first formed be thickened by the drying on them of fresh secretion, then flat scabs of a yellowish-brown colour are formed. These scabs are often raised at the circumference. Dry or moist honey-like scabs are never formed by the dry-up of vesicles.

It has been said that vesicles are formed at the orifice of sudoriferous ducts; but, although this may be true in some cases, all vesicles are not so constituted. The diseases or genera of the order vesiculæ are—sudamina, miliaria, eczema, and herpes.

Bullæ. The diseases belonging to the fourth order of skin-diseases are distinguished by the eruption of bullæ; that is to say, by collections of serosity of considerable size, situated directly beneath the cuticle, and raising the cuticle from the cutis. Bullæ differ from vesicles only in size; they vary in diameter from a quarter of an inch to two inches. Now and then the blebs, they are called, attain the dimensions of half a hen's egg. The fluid of bullæ, like that of vesicles, as well as the cuticle over them, may be transparent or opalescent. Bullæ may be followed by crusts or by ulcerations. Empyema and rupia are the only two diseases belonging to this order.

Pustulæ. The presence of pustules marks the fifth order. Pustules consist of pus from the moment of their formation. The inflammation, on which the formation of pus depends, extends some depth into the cutis; so that the collection of pus which constitutes the pustule is situated in the cutis and not merely on it immediately beneath the cuticle.

When vesicles become opalescent, the opalescence depends on the presence of pus-corpuscles and molecular granules; but true vesicles, whether their contents be transparent or milky, are never sunk into the cutis, and the pus-corpuscles when present constitute a very small proportion of the contents of the vesicle.

Pustules are followed by thick and dry or by honey-like crusts.

There are three forms of pustules—viz. *psyraciæ*, *phlyzaciæ*, and *achores*.

Psyraciæ are very little raised above the level of the cutis. They are seated in the hair-follicles—a hair passing through the centre of each pustule. The redness around this variety of pustule is frequently very trifling, especially when the pustules are placed at some distance from each other; when near together, however, the skin between may be red, hot, and swollen.

Phlyzaciæ are distinct pustules of some size, seated on elevated, inflamed bases. They are found especially on the trunk and extremities, and they terminate in small brown scabs.

Achores are very small pustules on comparatively large inflamed bases; base and collection of pus, however, form together only a small pustule. *Achores* are formed in considerable numbers in the vicinity of each other, the cutis between being red, hot, and swollen. They are more common on the faces of children than elsewhere. The secretion from them forms those very large, thick, irregular-shaped scabs, resembling dried honey in consistence, so common on the chins of children. *Achores* are inflamed hair and sebaceous follicles.

Impetigo, *ecthyma*, *equinia*, and *variola*, are the genera in the order *pustulæ*.

Parasitici. The diseases of the skin in which a vegetable parasite is invariably present are *tinea tonsurans*, *tinea favosa*, *tinea sycosis*, and *chloasma*. *Tinea decalvans* is also placed in this group.

There is only one disease characterised by the presence of an animal parasite, viz. *scabies*.

Papulæ. *Papulæ* are solid elevations of the cutis of small size, papilliform; their colour varies from dull white to bright red. When red, the colour may be removed for an instant by pressure, but the elevation remains. *Papulæ* are supposed by some to be enlarged papillæ; but the researches of Gustav Simon prove that *papulæ* may be formed at any point of the cutis by infiltration of the cutis at that point with serosity.

Three genera belong to the order *papulæ*, viz. *strophulus*, *lichen*, and *prurigo*.

Squamæ. The order *squamæ* is characterised by the formation of an excessive quantity of epithelium-scales loosely attached to each other and to the cutis. By the slightest friction dry opaque white scales are detached from the diseased surface.

Psoriasis and *pityriasis* are the only two genera of the order *squamæ*.

Tubercula. Solid hard elevations of the cutis, much larger than *papulæ*, are called *tubercula*. In this order are included several diseases anatomically and pathologically very different from each other. The order *tubercula* includes *molluscum*, *acne*, *lupus*, *elephantiasis*, *frambœsia*, *keloid*, and *cancer*.

Maculæ. The diseases of the order *maculæ* are characterised by the presence of too much or too little pigment in the parts of the skin affected, and therefore by white or dark-coloured spots. They are *lentigo*, *ephelis*, *vitaligo*, and *nigrities*.

Xerodermata. The order *xerodermata* is characterised by roughness, dryness, and loss of elasticity of the skin, without desquamation of the cuticle or any eruption. *Ichthyosis* and *xeroderma* (Wilson) are the diseases which constitute this order.

As each order of skin-diseases is divided into genera, so each genus is divided into species. The species of some genera differ from each other most decidedly both anatomically and pathologically. Some species, again, are

anatomically almost identical, although, pathologically considered, they are very different; while others, although very different in aspect, are pathologically alike. The specific name usually indicates some striking peculiarity of the disease; in some cases a peculiarity in the constitutional state, as in *rubeola maligna*, *roseola variolosa*; in some, a peculiarity in the local symptoms, *e.g.* *rubeola sine catarrho*; in some, in the form of the eruption, *e.g.* *roseola annulata*, *erythema circinnatum*; in others, in the time of the year at which they are supposed to prevail, *e.g.* *roseola æstiva*, *roseola autumnalis*; in others, in the seat, *e.g.* *herpes labialis*, *herpes præputialis*; in others, in the duration, *pemphigus diutinus*; in others, in the number of the spots, *pemphigus solitarius*; in others, in the colour of the eruption, *e.g.* *strophulus albidus*; in others, in the sensation of the patient, *e.g.* *prurigo formicans*.

EXANTHEMATA.

Roseola is an acute disease of trifling importance so far as concerns the safety or the suffering of the patient.

Roseola is so named from its colour. It is characterised by small rose-coloured spots, or by a roseate mottling of the skin. The spots are slightly raised above the level of the adjacent skin.

All varieties of *roseola* have a purely constitutional origin. There is one variety very common in children and young persons of both sexes (hence called by some *R. infantilis*), and especially prevalent in hot weather (and therefore named *R. æstiva*), in which rose-coloured spots and mottling give to the skin an appearance very closely resembling that of measles. From the rash of measles that of *roseola æstiva* differs, in the absence of a crescentic form or arrangement of the spots,—a character very rarely indeed wanting in measles; in the very irregular shape of the patches, and in their more rosy and generally paler hue; in their commencing on the most prominent parts of the face and extremities, instead of, as in measles, about the edge of the hairy scalp; in their limitation not uncommonly to a small part of the trunk, or to a single limb; and in their irregular course.

Trifling febrile disturbance usually precedes the rash for a few hours, or it may be a day or two, and dryness and redness of the fauces are common. The coryza, so distinctive of measles, is never observed in *roseola æstiva*. A measles-like rash, accompanied by sore-throat, and without coryza, should suggest the possibility of the case being *roseola æstiva*. If more than one child in the same family is affected, the probability is in favour of the disease being measles; but the writer has seen two sisters, after an error in diet, affected at the same time with well-marked *roseola æstiva*. Sometimes those of the greatest experience will be in doubt whether the case be one of *roseola æstiva* or of measles.

The duration of *roseola æstiva* is by no means constant. The rash may disappear in twenty-four hours, or it may remain out for four or five days. Occasionally it appears again after having once vanished.

A rose-coloured rash, very similar to that of *roseola æstiva*, sometimes precedes the eruption of small-pox. It occurs especially at the flexures of the joints. The pain in the head and back, and the vomiting, which precede the eruption, indicate the nature of the case, as no such symptoms precede the rash in any other form of *roseola*. Sometimes this variety of *roseola* bears a close resemblance to the rash of scarlet-fever.

A similar rash may accompany vaccinia, gout, and rheumatism; it may under these circumstances cover more or less of the trunk and extremities, or it may occur in patches. The specific name is derived from the constitutional disease to which the *roseola* is secondary, *e.g.* *roseola variolosa*, *roseola vaccina*, *roseola rheumatica*. The remaining two varieties of *roseola* differ altogether in appearance from *roseola æstiva*. Now and then in adults, as well as children, and more commonly on the arms than elsewhere, a few rose-coloured circular spots are seen, varying in size from a threepenny-piece to a

shilling. These spots are not elevated, or only very slightly so, and their colour disappears on pressure. As this affection has been thought to be more common in the autumn than at any other period of the year—though its especial prevalence at that time of year is doubtful—it has been called *roseola autumnalis*. It is a disease of no importance, and may not be accompanied by any general or internal local derangement, though occasionally there is a little febrile disturbance, or some dyspepsia. It rarely lasts more than a week or ten days. On the lower extremities, and sometimes on other parts, we observe several rose-coloured rings, varying in diameter from a quarter of an inch to an inch. The colour of the skin within the rings is quite natural. The rose-red colour is the only deviation of the skin from its healthy state. This form of *roseola* is named *roseola annulata*. Like *roseola autumnalis*, it is usually accompanied by a little febrile disturbance, and runs its course in a few days. Now and then, however, it is a chronic disease, lasting for many weeks.

Treatment. A warm bath or two—rest—simple diet—and a single dose of mercurial at bedtime, followed by a mild saline alkaline aperient the following morning, is usually all that is required in the treatment of a case of *roseola*. *Roseola infantilis* is sometimes the consequence of painful dentition; should the gums be hot and swollen, they ought to be scarified. In the chronic form of *roseola annulata*, the digestive organs are commonly much deranged, and the patient more or less generally out of health. Change of air—mild tonics, such as the mineral acids—and sea-bathing—are the best remedies. At the same time care must be taken to regulate the patient's diet. As the dyspepsia is of the atonic form, a glass or two of wine daily is usually of advantage. As this disease is sometimes dependent on uterine disturbance, the condition of the uterine and vaginal discharges should be ascertained.

The eruption proper to typhus fever, measles, typhoid fever, scarlet fever, and cholera is in reality a *roseola*, but differs in important particulars from the varieties just described. The rash of typhus and of measles as much merits the name of *roseola* as does that which precedes the eruption of small-pox. The mulberry rash of typhus fever differs from the other varieties of *roseola* by its dusky colour and the petechial character of the separate spots as the disease progresses—the exanthem of typhoid fever by the wide separation of its constituent spots from each other, and the papular form of the spots; that of measles by the crescentic arrangement of its spots; the rash of scarlet fever by its punctiform character, its colour, and the extent of surface covered; that of cholera by the size and irregular form of its spots and their tint. All are distinguished by their course, and by the constitutional disturbance which precedes and accompanies them.

Erythema is characterised by patches of redness of irregular form, and of rather large size, often somewhat raised above the level of the adjacent skin. When at its height the colour of the patch is vivid red; before disappearing the patch assumes a bluish hue. Pathologically considered, there are two distinct kinds of *erythema*, one having a local, the other a constitutional origin.

Varieties of erythema of local origin. When two folds of the skin overlap each other, the secretions accumulate and the two surfaces chafe each other; inflammation of the skin is the consequence—*intertrigo*, or *erythema intertrigo*, as it is called—a disease very common in the groins and necks of young children and fat women. A little moisture exudes from the inflamed surface.

The inflammation of the skin resulting from a burn is one variety of *erythema*. That peculiar inflammation of the skin which we call a chilblain, is, when dignified by a scientific name, *erythema pernio*. When the skin stretched over an oedematous part inflames, as often happens, the disease is *erythema læve*. If the patient lies long on one spot, and the skin over it inflames, it is *erythema*.

Chronic local erythema is pretty common on the face, around the lips, and on the buttocks of young children. The skin when inflamed about the lips, the orifice of the vagina, the prepuce, the groins, and the anus, is peculiarly liable to crack.

Intertrigo is best treated by frequent ablution, bathing the inflamed surface with an astringent wash,—a solution of acetate of lead is one of the best,—and then, after carefully drying the part, dusting it with an absorbent powder, such as starch, or oxide of zinc. It is important to bear in mind, with reference to erythema læve, that the inflammation of the skin increases the œdema of the subcutaneous tissue. If, as is usually the case, it is the lower extremities which are the seat of erythema læve, they should be raised to favour not only the return of blood from the limbs, but also the draining of the serosity out of the tissue, the skin covering which is inflamed. A few punctures in the thigh with a fine needle, by permitting the escape of serosity from the cellular tissue, will aid the cure of the erythema. If the œdema be not reduced, bullæ sometimes form on the erythematous surface, and finally the skin ulcerates or even sloughs. As to the erythema from pressure, that is best treated by careful drying of the part after washing, the application several times a day of spirit of wine, or an astringent solution, as alum; but above all, by the greatest attention to cleanliness and frequent change of position. A sore back from pressure very rarely occurs in fever or paraplegia, the diseases in which it is most common, if the patient be well nursed.

Varieties of erythema of constitutional origin: E. fugax, E. papulatum, E. nodosum, E. circinnatum (syn. annulatum), E. tuberculatum, E. marginatum. The local disease in these varieties of erythema, although characterised by redness, &c., hardly merits the name of inflammation, unless we give to that vague word a very wide signification. All these varieties of erythema are more common in those disposed to rheumatism.

Erythema fugax is distinguished by the sudden appearance of large red patches, and their equally sudden disappearance after a time varying from a few minutes to a few hours. The patches of erythema fugax are more common on the face than elsewhere; not infrequent on the trunk; rather rare on the extremities. The usual cause of erythema fugax is some article of diet. The patches disappear in less than half an hour. That erythema fugax results in some cases from nervous influence is rendered probable by such facts as this: a gentleman known to the writer cannot even think of heating condiments without experiencing a sensation of heat in the face, forehead, and scalp, conjoined with some redness of the part.

Erythema nodosum is a common affection in girls from six to twelve years of age, and not very rare in delicate boys and adult females, characterised by the eruption of distinctly elevated red patches of an oval, or more rarely circular, form. The oval patches are from one to two inches in length, the circular from half an inch to an inch in diameter. Each patch lasts from four to ten days; fresh patches appearing every day or two. The disease is commonly finished in a fortnight or three weeks. In persons past the middle of life it occasionally lasts for months. Each patch runs an acute course, but fresh patches come out every few days.

On their first appearance the colour of the patches is tolerably bright red; but when about to fade, the patches assume a bluish or violet tint. Exposure to cold also gives to the erythematous patch the same hue. This bluish colour is very characteristic of erythema. Over the anterior aspect of the tibia, which is the ordinary seat of erythema nodosum, the patches are commonly oval, their long axis being from above downwards; about the knee-joint, and at the back of the leg, they are usually circular. On the upper extremity, where they appear in rare cases only, they are also circular. The oval patches are from three quarters of an inch to two inches in length, the circular patches from half an inch to one inch in diameter. They are rarely seen on the lower extremities much above the knee, nor on the upper extremities above the elbow. It is very rare for patches to occur on the trunk.

Occasionally, several patches are evolved in the vicinity of each other; and their margins coalescing, a broad red patch is formed, here and there hard, elevated, and very tender. The redness of erysipelas terminates by a well-defined line; in all other forms of erythema it shades off into the hue of the adjacent skin. The margin of an erysipelatous patch is as much raised as its centre; the elevation of a patch of erythema nodosum ceases by degrees with the redness. When the finger is passed over a patch of erythema nodosum, it feels as though the hardness were caused by something buried under as well as in the skin. Erysipelatous hardness is brawny in character and superficial. When several patches of erythema nodosum are present, the disease can hardly be confounded with erysipelas. The largest patches of erythema nodosum now and then convey to the finger a sensation of fluctuation; but they never suppurate, and the sensation of fluctuation is probably due to the presence of serosity in the subcutaneous cellular tissue.

Erythema tuberculatum and *papulatum*. When patches, agreeing in other points with those just described as characteristic of erythema nodosum, do not exceed a fourpenny-piece in size, the disease is called erythema tuberculatum; when not larger than a very small split-pea, the disease is called erythema papulatum. Sometimes circumscribed patches of a bright red colour, studded with deeper-coloured points, which to the eye resemble papulæ, but are without the elevation and hardness of true papulæ, appear on the arms, neck, and breast; the colour and slight elevation are both temporarily removable by the pressure of the finger. To these patches also the term erythema papulatum has been applied.

Erythema circinnatum is by no means a very common disease. It affects children and adults, and ordinarily supervenes in the course of an attack of acute rheumatism. Its usual seat is the trunk.

The patches are ring-shaped. Sometimes, however, the rings are imperfect; and not infrequently several rings coalesce at their margins. The rings are red, distinctly raised, terminate abruptly externally, both as regards their colour and elevation, but shade off gradually towards the centre. Within the ring the skin has a faintly yellowish tint. The breadth of the red ring is about one-third of an inch. The patches are quite smooth; there is not a trace of scales, vesicles, or scabs on their surfaces. The colour of the rings of roseola annulata is darker than that of erythema circinnatum, the elevation is scarcely perceptible, the outer margin is not abrupt, and the centre is the colour of the natural skin, instead of yellowish. Erythema circinnatum, when acute, runs its course in about a fortnight or three weeks. There is a chronic variety, however, in which the rings are incomplete, and to it the name of erythema marginatum has been applied. Willan mentions that it occurs on the extremities and loins of aged persons suffering from internal disorders, and that its occurrence is an unfavourable sign.

A little desquamation of the cuticle covering the red patches follows the disappearance of all the varieties of erythema and roseola. The eruption of roseola itches slightly; that of erythema usually itches, burns, or tingles in a trifling degree.

It is evident that there is little or no essential difference between roseola and erythema; and that, excluding inflammation of the skin, dependent altogether on local causes, and that variety of roseola which so closely resembles measles, the other varieties of roseola and erythema might well be grouped together into one genus, and this whether regard be had to their local or general pathology, or to their treatment.

A few warm baths, rest, mild aperients, simple salines, and a light diet, so long as the skin is hot, the pulse quick, and the tongue white; attention to the digestive organs, mineral acids, and vegetable tonics, after the febrile disturbance has ceased,—these are the remedies for all. Erythema nodosum, tuberculatum, and papulatum, and the chronic variety of erythema circinnatum, usually occur in delicate persons; and in their treatment quinine is said to be particularly useful. Dr. A. Todd Thompson, whose remarks on

treatment are always worthy of attention, found bark in many cases much more beneficial than quinine. In women past the middle of life, the eruption of erythema nodosum is thought to be connected with the cessation of the menstrual discharge. Erythema circinnatum occurring in the course of acute rheumatism disappears spontaneously.

The pathology and etiology of *urticaria*, or nettle-rash, are so very closely related to erythema fugax, and the two so often occur in the same individual, that we pass naturally from the genus erythema to urticaria. Yet urticaria is not correctly placed among the exanthemata. In urticaria there is something more than redness disappearing or fading on pressure; there are wheals, or pomphi, as they have been called.

Wheals are flat elevated patches of the skin. The sting of a nettle, the bite of a bug, the stroke of a whip are each followed by a wheal. Wheals differ much in form, size, and colour. In form they may be circular, oval, or irregular; in size, they vary from two lines to some inches in length; in colour, from almost white to deep purple.

In urticaria each wheal is seated on a red patch; sometimes the patch is very large, the wheals small; sometimes the redness forms merely a narrow halo around the wheal; several wheals may be seated on the same red patch. Wheals frequently appear and disappear again with singular rapidity. Now and then the red patches remain for a while after the wheals have vanished; in some cases the red patch precedes the eruption of the wheal, in others the wheal comes out first; while in others, again, they appear simultaneously. When the red patch only is present, the disease may be very readily confounded with erythema; a little friction of the part, however, will prevent the mistake by bringing out the wheal. Now and then the surface covered by the redness is very considerable in extent, and then the wheals not being present, the case might possibly be taken for scarlatina. There may usually be detected on the red parts one or two wheals imperfectly evolved, which will reveal the true nature of the case.

Patients often mistake the pale elevations of the cutis for blebs, and say that large blisters occasionally come out over them. The wheals in urticaria itch, tingle, and burn. These sensations are often almost intolerable. Usually they are aggravated at night when the patient is warm in bed, when seated by a fire, and by the use of stimulating articles of diet. Now and then, however, the wheals and the itching, tingling, and burning sensations are only present when the patient is exposed to cold. Any change of temperature suffices in some cases to determine the evolution of the wheals. The structure of the wheals in urticaria has not been very clearly made out. The redness is, of course, caused by repletion of the vessels of the cutis; but to what is the elevation and pallor of the wheals due? Gustav Simon says that if a needle be passed into the cutis constituting a pale wheal, a little clear serosity only escapes; and he concludes from this that the swelling is occasioned by the presence of serosity in the substance of the cutis. The pallor is attributed to the quantity of serosity effused being out of proportion to the number of vessels loaded with blood. The sudden appearance and disappearance of the wheals seem, however, to be opposed to these ideas.

Urticaria is a very common disease. It occurs at all ages. Persons prone to rheumatism are especially liable to urticaria.

Varieties of urticaria. *Local urticaria* results from the application to the skin of certain irritants, *e. g.* a blow, a sting, &c.

Acute varieties. A most acute and severe form of urticaria is not unfrequently the result of a single error in diet. In some persons shell-fish, in others pork, in others pastry, in others the more common articles of diet, as eggs or sugar, produce an attack of urticaria, and this although the food be the best of its kind. In some persons an attack of urticaria only occasionally follows the use of particular substances; in others, it is the invariable conse-

quence. The patient is said to be poisoned by what he has taken. An attack of urticaria having such an origin usually terminates in two or three days.

An acute attack of urticaria sometimes occurs without the patient having committed any error in diet. It is then generally preceded for a day or two by some febrile disturbance. There are no special symptoms present in these cases to indicate that the pyrexia is only the prelude of an attack of nettle-rash. The eruption of the wheals is the first intimation of the exact nature of the disease. This variety of urticaria ordinarily lasts a week. It is termed *U. febrilis*.

Treatment. When acute urticaria arises from the patient having eaten some substance which he has imperfectly digested, an emetic, followed by a mercurial and saline aperient, is generally all that is necessary for the cure. If there be much depression at the outset, it may be necessary to give a little ammonia; or, on the other hand, if the febrile disturbance be great, to take a little blood from the arm.

Chronic varieties. More frequently urticaria is a chronic disease, and it may then last for years. Sometimes the wheals are confluent, or almost so, and then the disease is called *urticaria conferta*. Occasionally, even in comparatively chronic cases, the wheals that first appear remain out till the patient is permanently well. Urticaria in which the wheals are thus permanent is called *urticaria perstans*. Far more commonly the wheals come out in crops, so to say, which last only a few hours, fresh crops appearing with every change of temperature, with every abnormality of diet, or on the slightest friction. Now and then not a wheal appears for a week or two, and then a fresh crop comes out. Urticaria, characterised by these evanescent wheals, is *urticaria evanida*. In rare cases the wheals attain a very large size, and then the disease is *urticaria tuberosa*; in still rarer cases the patient suffers from the burning, itching, and tingling sensations in numerous parts where no wheals appear, and then Willan called the disease *urticaria subcutanea*. In regard of the species of urticaria, all the important points may be summed up thus: the disease is now and then a very acute disease, distinctly referrible to an error in diet; now and then an acute disease not referrible to error in diet; more often the disease is chronic, the wheals appearing and disappearing rapidly on the slightest cause, or even without any known cause.

In the *treatment of the chronic forms of urticaria* especial attention is to be paid to the patient's diet. In some cases abstinence from coffee, in some from tea, in some from milk, in some from porter, in others from the water they were drinking, has been followed by recovery. I know a young lady who always suffers from urticaria when she resides in a particular locality, from the quality, it seems to me, either of the air or water at that spot; and she informed me that many persons in the same village suffer from the disease. While residing there, medicine has little effect on the disease; when she leaves that village, no medicine is required for her cure.

After regulating the diet, a mild course of antacid saline aperients is often useful. In other cases saline aperients, combined with a bitter infusion and a mineral acid, seem to be the most efficacious remedies.

A course of cold sea-baths is sometimes followed by recovery when other means have failed. If the patient is plethoric, and the pulse is full and hard, a single blood-letting, to a moderate extent, affords much relief. In obstinate cases arsenic in small doses—as three minims of liquor potassæ arsenitis three times a-day—continued for some time, has effected a cure. Some physicians attach much importance in the treatment of urticaria to quinine, in doses of two or three grains three times a-day. Colchicum is with others a favourite remedy. Carbonate of potash or liquor potassæ, with a bitter infusion, three times a-day, is sometimes useful, by correcting deranged conditions of the stomach.

The disease may often be kept in abeyance, the eruption of fresh wheals be prevented, and the irritation of those present be allayed, by sponging the whole surface night and morning with lemon-juice or vinegar. Mr. Wilson

speaks very highly, for the latter purpose, of a lotion composed of bichloride of mercury, from five to ten grains, spirits of rosemary and spirits of wine of each one ounce, and six ounces of the emulsion of bitter almonds.

If a child suffering from urticaria be cutting its teeth, and the gums are hot, dry, and tender, they should be lanced. A single dose of calomel and jalap usually suffices to cure the disease in the young child.

HÆMORRHAGIA.

Purpura is characterised by an eruption of spots (called *petechiæ*) or patches (called *vibices* or *ecchymoses*), both due to hæmorrhage into the derma, varying in tint from bright-red to violet. In diameter they are less than a line to more than an inch; the smallest spots are round, the larger more irregular in shape. At first the spots have an abrupt well-defined margin; but after a time their outline is gradually lost in the surrounding skin. Their distinguishing character is that they do not disappear or fade under pressure, in this respect differing from all forms of eruption with which they could be confounded. In a few days they begin to fade and slowly disappear, becoming orange-coloured and yellowish; new spots appear as old ones die away.

Purpura has been subdivided into *P. simplex* and *P. hæmorrhagica*. The latter is only a severer form of the former, in which hæmorrhage takes place not only into the skin but from the mucous membranes of the nose, the alimentary canal, the urinary passages, and other parts. Willan described a variety, under the name of *P. urticans*, in which there is a reddish elevation of the skin resembling a wheal, which subsides in a few days, and leaves a livid spot on the level of the skin. It is not accompanied with tingling or itching.

In mild cases of purpura, there is little or no disturbance of the general health. In severer cases, the eruption is often preceded by febrile symptoms, lassitude, and pains in the limbs. In some cases, however, without any previous constitutional disturbance, profuse hæmorrhage may occur both into the skin and mucous membranes.

Scorbutus is quite a distinct disease from purpura, though, like it, accompanied by cutaneous hæmorrhage. The gums are not spongy in purpura, nor is there usually the yellow sallow hue which is met with in scurvy. Some of the acute specific diseases are occasionally accompanied with *petechiæ*, and typhus is specially called the petechial fever from the ordinary characters of its eruption. Other symptoms will enable the practitioner easily to distinguish these eruptions from purpura. Neither the pathology nor the etiology of purpura is understood. It is not dependent on a want of fibrin in the blood, nor is it caused by the want of fresh vegetables, or even by poor living.

Treatment. Astringents, such as gallic acid and acetate of lead, are occasionally of use. The tincture of the sesquichloride of iron and mineral acids have been useful in other cases. Turpentine and creosote have been much extolled by some writers. Dr. Williams thinks that purpura is often connected with hepatic congestion and imperfect secretion of bile, and is best treated by remedies which tend to relieve this state. T. H.

VESICULÆ.

The vesicles to which the term *sudamina* is applied resemble minute drops of perspiration; they are colourless and very transparent. There is no redness around them. Sometimes they are so small that they are more easily detected by the finger than by the eye. In two or three days the vesicles either burst or the fluid in them disappears, and there is a little furfuraceous desquamation of the cuticle at the parts where they were situated. The contents of a sudamen never become opalescent.

Sudamina appear in the course of certain acute and chronic affections,

and are especially common in typhoid fever, during the third week of the disease. A single crop of sudamina never lasts more than two or three days. I think, in common with others, that these vesicles are seated at the orifices of the sweat-ducts, and that they are connected with the occurrence of perspiration. They may cover the whole anterior and lateral regions of the trunk; but more commonly they occupy those parts to which perspiration is often limited, *e. g.* the base of the neck, the sides of the thorax, the epigastrium, and the groins.

The contents of the vesicles is almost always acid. Sudamina rarely occur after the middle period of life. They are of no value as a guide for prognosis; and as to treatment, they themselves require none. A crop of sudamina indicate that the patient has perspired, and should lead to inquiries into the ventilation and the temperature of the room, the condition of the linen of the patient, &c.

Miliaria. Miliary vesicles are acuminate with a red halo around their bases. Their contents quickly lose their transparency, and become almost or quite purulent in appearance. Miliary vesicles occur, like sudamina, in the course of other affections. They are often seen on the trunk and extremities in acute rheumatism. They differ from sudamina in being acuminate, in the opacity of their contents soon after their eruption, and in the redness of the skin around.

Like sudamina, they appear to be connected with the occurrence of perspiration. During the summer months it is very common to see the trunk of children, and even of adults, who perspire freely from exercise or other cause, and especially if they are not frequently washed, covered with a crop of minute miliary vesicles. In these cases, the redness around each vesicle is sometimes much more readily seen than the vesicles themselves, and then the disease may be mistaken for roseola æstiva. Not unfrequently roseola æstiva is complicated with the eruption of a few miliary vesicles.

Frequent ablution and a gentle purge are all that is required in the treatment of the miliary vesicular eruption of children. There is an epidemic febrile disease of from eight to ten days' duration, characterised by profuse sweating and a miliary eruption. It has been called miliary fever; some cases of it are detailed in Rayer's work on skin-diseases. Some persons use the term miliary vesicles to include sudamina and miliary vesicles proper.

Eczema is a very common disease, and occurs at all ages. It is characterised by the eruption of small vesicles on imperfectly defined patches of skin, of some extent. The vesicles are usually pretty thickly set. Each vesicle is surrounded by more or less inflammatory redness. Sometimes the redness around the vesicles is scarcely perceptible, sometimes the whole skin between them is uniformly red, hot, and swollen; in the latter case, however, detached vesicles are always to be found at the margin of the patches, each having its areola of redness. When the vesicles burst, thin scales or scabs cover the surface of the patches. These scales or scabs are composed of epithelium, and the fixed constituents of the fluid of the vesicles. When the fluid in the vesicles contains but little animal matter, then the scales are thin, white, and opaque, and the disease may be mistaken for one of those belonging to the order squamæ.

When the fluid of the vesicles contains much animal matter, then the scabs are brownish or yellowish in hue. Still the scabs formed from the drying up of a crop of the vesicles of uncomplicated eczema are never thick. The disease may disappear with the drying up of the first crop of vesicles; but this is by no means constantly the case. Two, three, or more crops of vesicles may follow each other in quick succession; and the surface on which they are seated may be red and raw in appearance, and a clear serous fluid, strongly alkaline in reaction, ooze from it in considerable quantity. This fluid excites inflammation of the surface over which it flows. It scalds, as it is said. Instead of being

raw in appearance, it may be that the surface is hot, red, and swollen; and just under the cuticle are perfectly flat irregularly-shaped collections of serosity, or of somewhat purulent-looking fluid. The appearance is as if turbid serosity or thin pus were burrowing in all directions just under the epidermis. The fluid in this, as in other forms of eczema, is alkaline. Scabs of large extent, but still thin, are formed by the drying up of this subcuticular fluid.

Where the cuticle is rather thick, and the vesicles are very small, the surface may seem to be red and rough only, with cracks here and there, from which a more or less alkaline serosity oozes in small quantity. The surface thus affected is often of considerable extent. It is a common form of eczema on the anterior aspect of the leg in persons past the middle period of life. The urine of those who suffer from it often contains a large quantity of the crystals of oxalate of lime.

Varieties of eczema. As to the nominal varieties of eczema, the disease is called eczema vulgare or simplex, when the vesicles are distinct from each other, though pretty closely crowded; last a few days only, and then dry up and form furfuraceous scales; the inflammation of the cutis in *E. simplex* is never very severe, and may be trifling. *E. simplex* may be excited by any direct irritant of the skin; as, for example, a stimulating liniment, exposure to the direct rays of the sun or of a strong fire, sugar, sulphur.

Eczema rubrum is distinguished from *E. simplex* by the degree of inflammation that accompanies the eruption; the cutis between the vesicles is uniformly inflamed; eczema simplex may therefore pass into eczema rubrum. In eczema rubrum the cutaneous and subcutaneous tissues are often considerably swollen; the swelling is, for the most part, due to the effusion of serosity.

There are two diseased states of the skin called by the common name of eczema impetiginodes. In one, the inflammation is very severe, and the secretion is here and there purulent; in the other, eczema is complicated with impetigo, *i. e.* with suppurative inflammation of the hair-follicles.

The face, the hairy scalp, and the skin behind the ears are all common seats of eczema; but there is no part of the trunk or extremities which it may not, nay does not, frequently affect.

Before and during the period of the first dentition, eczema is by far the most common of the diseases of the scalp. If a single crop of vesicles only appear, the disease will run its course in a week or ten days; but if crop after crop of vesicles follow each other, or if the surface is highly inflamed and "weeps," the disease may continue for a considerable length of time. When very obstinate, lasting for years, it has been called eczema inveteratum. Strumous children, from five to twelve years of age, are very liable to eczema of an obstinate character at the flexures of the elbow and knee joints. An acute attack of eczema is sometimes preceded for a day or two by tolerably severe febrile disturbance. There is nothing characteristic, however, in the febrile symptoms; but the patient who has had one attack being very liable to others, he may suspect its nature. Sometimes, too, he feels before the eruption appears a peculiar heat and tingling of the part about to be the seat of the eruption.

Parts affected with eczema burn, tingle, and itch; but the heat and tingling are usually much more marked than is the itching. Some local varieties of eczema, however, are attended with most troublesome itching; thus in eczema of the anus, of the labia pudendi, and of the scrotum, especially in old men, whose urine dribbling away irritates that part, the itching is often intolerable. Eczema is not contagious.

In children, as a rule, eczema is secondary to some constitutional state. In adult age it is more commonly due to direct irritation. In females it now and then appears in connexion with derangement of the catamenial function, without known local exciting cause. Eczema of the lower extremities is sometimes secondary to a varicose condition of the veins.

Treatment. The treatment of an acute attack of eczema must be in-

fluenced by the severity of the local affection, the presence of febrile disturbance, and the age and strength of the patient.

If the disease be acute, the local affection extensive, and accompanied by a good deal of heat, redness, and swelling, and the patient in the prime of life and robust, the best treatment is to take a moderate quantity of blood from the arm, to give a brisk calomel-and-colocynth purge, to follow this by a saline antacid aperient, and to bathe the part itself with tepid goulard water. After the bowels have been freely acted on, small doses of antimony may be given every three or four hours. The diet in such cases should be low. If the patient be less robust, then the bloodletting must be omitted, and the purging and other treatment be less active.

If the disease be chronic, and the inflammation moderate in degree, a bitter acid aperient, such as sulphate of magnesia one drachm, dilute sulphuric acid 10 drops, infusion of gentian $1\frac{1}{2}$ ounce, two or three times a day, is often very useful. Young children require occasionally a calomel-and-jalap aperient at bedtime. In the chronic forms care must be taken to ascertain that the patient is committing no error in diet. It is only in the aged or the delicate that stimulants, as wine or beer, are admissible. Slightly astringent local applications, as zinc ointment, are the best for mild cases. If the disease is very chronic, and there is little heat of the part, stronger local means are required, such as an ointment composed of half a drachm of the hypochloride of sulphur to 1 ounce of simple cerate, or a scruple of iodide of sulphur to half an ounce of simple cerate. In the strumous variety above mentioned as so common at the bends of the elbows and knees, and in that in which the cuticle is rough and cracked, and there is serous fluid oozing from the surface, a piece of linen soaked in a solution of nitrate of silver, a scruple to an ounce of water, may be applied twice a day. When, in the last-mentioned form, the urine contains a very large quantity of oxalate-of-lime crystals, the nitro-muriatic acid, with decoction of bark and a good diet, should be prescribed. In strumous children, cod-liver oil and a good diet are essential to the cure. When young children suffer from eczema of the scalp, and the gums are hot, dry, and swollen, they must be lanced. If the disease continue, and the inflammation does not involve the cellular tissue, I have seen the disease rapidly yield to the plan of treatment recommended by Hebra. The hair being cut off by a fine pair of scissors, and the scabs removed by linseed-meal or bread-and-water poultices, linseed-oil is to be applied at bedtime to the whole scalp, and the following morning the part is to be covered with liquid pitch; a single application is sometimes sufficient for the cure; when the pitch peels off, the scalp is found free from eruption or inflammation. Care must be taken not to employ so stimulating an application as liquid pitch when there is much heat and swelling of the part, for a child in the Hospital for Sick Children was nearly killed under such circumstances by the inflammation set up by the pitch. The inflammation extended from the scalp down the neck, and even below the clavicles. Abscesses of some size formed in the cellular tissue of the inflamed parts. However, when the child recovered from the terrible disease excited by the pitch, it was free from the eczema. It had been suffering from the affection of the scalp for two years; sometimes it was almost well, and then again, without apparent cause, an acute attack supervened, and the child was as bad as ever; the cure effected by the pitch was permanent. In very obstinate cases, in children as well as adults, arsenic administered internally exerts a decidedly favourable influence: three or four minims of the liquor potassæ arsenitis in a little water twice a-day to an adult, and a single minim to a child.

Parts affected with eczema should be washed frequently. Strong soaps should not be employed. Some physicians recommend the patient to use a little bran-water only; others employ egg instead of soap for washing the part. It is desirable to prevent the secretion from the inflamed surface running over the adjacent healthy skin; therefore the part should very frequently be wiped gently with a piece of soft lint. Dr. H. Bennet speaks in very high

terms of the advantage he has seen follow from keeping the part constantly wet with a solution of subcarbonate of soda two drachms to a pint and half of water. To prevent the lint drying, it is necessary to cover it with oil-silk or gutta-percha.

The treatment of eczema may be thus summed up. If the local affection be manifestly inflammatory, it must first be treated altogether independently of the special eruption. When the active inflammatory stage has passed by, stimulating astringents must be applied locally, and the constitutional derangements treated as though there was no local affection; and lastly, these means failing, those remedies must be employed which may be denominated empirical. Always bearing in mind the importance of a diet regulated according to the age and general powers of the patient, and the necessity for local cleanliness.

Herpes is, like eczema, a non-contagious vesicular disease very common at all ages. It differs from eczema, however, in several particulars. The vesicles are arranged in groups on small, or at least not very large, pretty well-defined and somewhat elevated red patches. The vesicles of eczema are always small; those of herpes usually of some size.

The fluid of the vesicles is at first quite transparent, but it soon grows opalescent or puriform, and after a short time the fluid and the epidermic covering of the vesicles concrete into a thin pale brownish scab. When quite transparent, the fluid of the vesicles is slightly alkaline or neutral to test-paper; when opalescent, neutral or acid. The fluid of the vesicles in herpes never has the strongly alkaline reaction so remarkable in the transparent fluid that "weeps" from the red surface of a patch of eczema.

Varieties of herpes.—The red slightly elevated patch that so often forms on the lip during that little feverish attack commonly called a cold, and which is shortly after covered by a crop of vesicles, is *H. labialis*. In a day or two the vesicles are replaced by a thin brownish scab; in two or three days more the scab falls off, and a red stain only remains. When such an eruption occurs on the prepuce, as it often does, it is *herpes præputialis*. Patches identical with these, except that they are broader, and that the vesicles on them are larger, may appear on any part of the body, constituting *herpes phlyctænodes*. The cheek is a common seat of *herpes phlyctænodes*. Several patches often appear in the vicinity of each other. The disease ceases, as a rule, in less than a fortnight. Sometimes a week suffices for it to run its course.

Herpes zoster, zona, or shingles, as it is vulgarly called, is distinguished from the other varieties of herpes by the number and position of the patches of vesicles. Several patches, distinctly separated from each other, appear at the same time or in succession. These patches are usually oval, and arranged on a line passing somewhat obliquely downwards and forwards from the spine to the middle line in front. Most commonly they are seated on the thorax, next on the abdomen, and rarely on the face and neck. The patient is usually poorly for two or three days before the vesicular patches show themselves; sometimes considerable febrile disturbance precedes the eruption, and occasionally the patient suffers severe burning pain in the part where the eruption is about to appear, and even deep-seated pain in the chest when the thoracic parietes are to be its seat.

At first the contents of the vesicles are transparent, then turbid, and then thin brownish scabs follow. The disease runs its course in ten days or a fortnight. In rare cases, and only in adults, after the scabs fall off, the part on which they were seated is for some time the seat of severe neuralgic pain.

Herpes zoster affects young children much more frequently than it does adults. No age, however, is exempt. In children and young or middle-aged adults it is a disease, medically speaking, of little moment.

Treatment. A mild aperient and a simple saline only are needed. No local treatment is required; nay, local applications very often seem to do harm. *Herpes zoster* is an acute disease, having a definite course and dura-

tion; a disease that, if let alone, is sure to get well, supposing the patient not to be very old or infirm. But the vulgar have an idea that, if the disease pass round the body, death from it is certain; and in some parts of the country the poor regard it as a most serious disease. Gangrene of the parts affected in very rare cases follows in infirm aged persons.

The neuralgia which now and then occurs as a sequel to the eruption, is best treated by local anæsthetics, as belladonna.

As to the pathology of herpes zoster the eruption is secondary to a general febrile affection, and the seat of the eruption is determined by the distribution of particular nerves, and most commonly of the dorsal nerves. The pain that precedes the redness, the limitation of the disease to one-half the body, the frequency with which it follows the course of some of the dorsal nerves on the thorax and abdomen, and even the fact that in some cases the upper arm has formed, so to say, part of the semicircle,—all point to this conclusion. In reference to these last facts it may be observed that the lower intercostal nerves supply cutaneous branches to the abdominal integument, and that the second dorsal nerve supplies a branch to the skin of the upper arm, viz. the intercosto-humeral.

Herpes iris is a very rare variety. Each patch is about the size of a sixpence, and constituted by three or four concentric rings of different shades of red. On these rings the vesicles are situated; a solitary vesicle occupies the centre. Willan states that the back of the hand is the most common seat of herpes iris; that it is not connected with any perceptible constitutional disorder; that it disappears spontaneously; and that it is limited to young persons.

Herpes circinnatus occurs at all ages. The breadth of the red ring in herpes circinnatus varies from a line to a third of an inch; the diameter of the ring, from a quarter to two inches; the size of the vesicles, from the smallest perceptible by the eye to almost as large as the half of a small split-pea.

When the vesicles are of large size, they undergo the same changes which vesicles of herpes zoster experience; that is to say, at first the fluid in the vesicles is transparent, then turbid, and then the walls of the vesicles and their contents dry up into brownish scabs. A second crop of vesicles may follow; but the disease usually runs its course in a week or ten days. Sometimes several patches of the same kind appear in succession on various parts, and thus the disease may be prolonged for some little time.

As to the treatment of herpes circinnatus with large vesicles, a gentle aperient, rest, and a light diet only are required.

That variety of herpes circinnatus in which the vesicles are very small is by far the most common and the most important. It is the *ringworm* of the face, trunk, and extremities. From the frequency with which minute scales are found on the red ring, it may be called the furfuraceous variety of herpes circinnatus, and to this variety only the following remarks apply.

Herpes circinnatus commences as a red spot; and the annular shape is the result of the extension of the inflammation at the margin of the spot while the centre regains its healthy aspect. It is one of the centrifugal affections of the skin. Occasionally a second, a third, and even a fourth ring is seen within or without the primary circle. Every now and then we meet with cases in which the centre of the ring, instead of regaining its healthy structure as the margin extends, is the seat of repeated eruptions of very minute vesicles, and so has a rough, rather scaly, appearance. This latter form is especially common in strumous children, whose skin is naturally rough. It is peculiarly chronic in its course.

The furfuraceous variety of herpes circinnatus is a purely local affection. In this it differs from most of the other species of herpes. In herpes zoster, phlyctenodes, and labialis, the eruption is preceded by, and is altogether secondary to, a general febrile state. The local affection in these diseases bears the same sort of relation to the general state that the rash of measles

bears to the general state that precedes its eruption. *Herpes circinnatus* is not secondary to, or even accompanied by, any constitutional derangement. It differs in another particular from most of the varieties previously described. They are acute diseases; it may be a chronic affection. Each crop of vesicles runs, it is true, an acute course; but repeated crops often give to the disease a chronic character. The furfuraceous variety of *herpes circinnatus* may by the inexperienced student be confounded with *roseola annulata*, *erythema circinnatum*, *psoriasis vulgaris*, *lichen circumscriptus*, and *tinea tonsurans*. In *psoriasis* the elevation of the red ring is greater than in *herpes circinnatus*, and the scales form the prominent feature of the local disease, instead of requiring to be looked for, as in *herpes circinnatus*. There are no elevation of the skin, no vesicles, and no scales in *roseola annulata*. The abrupt outer margin, the breadth of the ring, the yellowish tint of the centre, and the absence of vesicles and scales, distinguish *erythema circinnatum*. *Lichen* is a papular disease.

Treatment. Topical applications only are required for the cure of the furfuraceous variety of *herpes circinnatus*. Local astringents and stimulants are the remedies. The vulgar apply ink, and cure many cases by it. A concentrated solution of sulphate of iron answers well in some cases; so also does a saturated solution of gallic acid. A single application of strong acetic acid, or of a strong solution of nitrate of silver (a drachm to the ounce of distilled water), or of blister-fluid, will occasionally suffice to remove a patch of *herpes circinnatus* which has resisted less powerful agents. This furfuraceous variety of *herpes circinnatus* is contagious. It is almost limited to the young, and is far more common in childhood than in early adult age. In and by itself *herpes circinnatus* is a trifling affection; but considered in reference to the relation it bears to the development of the vegetable parasites, it is a very important disease.

PARASITICI.

Tinea is the generic name of all the diseases of the skin characterised by the presence of vegetable growths in the substance of the hair.

Tinea tonsurans is a very common disease of the hairy scalp, seen only in children, and by far the most frequently between the ages of two and twelve years. It is called *Porrigio scutulata* by Willan, *Herpes tonsdens* by Cazenave and G. Simon, and *Trichinosis furfuracea* by E. Wilson.

Tinea tonsurans occurs in more or less circular patches varying in size from a sixpence to a crown-piece. All the hairs on the patches appear to have been evenly cut off at about an eighth of an inch from the surface of the scalp. These short hairs are much thicker and more opaque than are the hairs on the other parts of the head, and as the diseased hairs have lost their elasticity, they are here and there twisted or bent at an angle on themselves. The surface of this patch is generally covered with numerous loosely attached opaque white scales, and imbedded in these are many opaque, thick, twisted short hairs. When the scalliness of the patch is trifling, the orifice of each hair-follicle may be observed to be surrounded by an opaque white fringe, formed of accumulated epithelium, and the hair-follicles themselves are too prominent.

The patches on which the hairs, &c. are thus diseased are very slightly raised, and are a little redder and hotter than the other parts of the scalp.

Microscopic examination. The thickness, opacity, brittleness, and loss of elasticity of the hairs are seen, by the aid of a magnifying power of two hundred diameters, to be due to the presence in the substance of the hair of a vegetable parasite. The scales are formed of epithelium, studded with the sporules and mycelium of the same parasite. The plant is the trichophyton *tonsurans*; the sporules of the plant are found between the inner root-sheath of the hair-follicle and the hair; from this spot the parasite enters the hair; and the mycelium, bearing innumerable sporules, passes between the anatomical elements of the hair, separating them from each other in the most

remarkable manner. Passing up, from the interior of the hair-follicle to its orifice, the mycelium and sporules spread in all directions among the epithelial scales.

Pathology. Some writers maintain that *tinea tonsurans* and *herpes circinnatus* are the same disease. The closeness of the relation between the two is shown by the fact that a patch of *herpes circinnatus* seated on the forehead or back of the neck, as not infrequently happens, and extending in size till the upper part of the ring involves the hairy scalp, may retain on the hairless part the characters of *herpes circinnatus*, while that portion of the ring which occupies the hairy scalp has all the characters of *tinea tonsurans*; and also by the fact, that in the scales, which can be scraped from the surface of the red ring of *herpes circinnatus* of the trunk, are occasionally to be found some of the mycelium and sporules of the little fungus.

But, on the one hand, a patch of *herpes circinnatus* is often seen on the trunk, and occasionally on the scalp, without a trace of the trichophyton to be detected among the débris of its vesicles; and on the other hand, a patch of *tinea tonsurans* is occasionally seen on the scalp, on and around which no trace of *herpes circinnatus* can be found.

What we know concerning the relations between *herpes circinnatus* and *tinea tonsurans* is,

1st. That it is only now and then that the trichophyton *tonsurans* is found in the scales of the furfuraceous variety of *herpes circinnatus* seated on the trunk.

2d. That this variety of *herpes* is sometimes seen on the scalp, presenting characters identical with those it exhibits when seated on the trunk.

3d. That a disease of the scalp, which at its commencement differs in no particular from *herpes circinnatus*, may in its progress assume all the characters proper to *tinea tonsurans*.

4th. That at the margin of a patch of *tinea tonsurans* we can occasionally detect vesicles or the remains of vesicles.

5th. That patches of *tinea tonsurans* are constantly seen, on which from first to last no trace of vesicles can be detected, and the margins of which in no way differ from their centres.

6th. That while patches on the scalp which offer only the characters of *herpes circinnatus* are easily cured by simple applications, the patches which are distinguished by the signs proper to *tinea tonsurans* are altogether unaffected by the same means.

From these facts it follows,

1st. That *herpes circinnatus* and *tinea tonsurans* are distinct diseases.

2d. That *tinea tonsurans* owes its peculiar characters to the presence of a parasitic vegetable growth.

3d. That the secretions of the part of the skin affected with *herpes circinnatus* form a favourable nidus for the growth of the parasite.

In *tinea tonsurans* there is first some disorder in the secretions of the hair-follicles,—a disorder, it may be, attended with no changes perceptible to the eye. If sporules of the trichophyton *tonsurans* fall on the soil so prepared, they take root; the plant grows downwards between the hair and its root-sheath—outwards, upon and among the epithelium of the scalp; upwards into the hair, penetrating it, and passing into its shaft. To the existence of the parasite all the visible phenomena are due. Its presence in the substance of the hair causes its increased thickness, opacity, loss of elasticity, and brittleness. Its presence in and among the epithelium leads to the desquamation of the latter, and, as a consequence, to the abundance of the scales; its presence in the hair-follicles to the swelling of the follicles, and to the little fringe around their orifice, and also to the determination of blood to the part. The elevation of the part and its increased temperature are consequent on the flow of blood to it. *Tinea tonsurans* is undoubtedly contagious.

Treatment. The great object to be attained in the treatment of *tinea tonsurans*, whether the disease be primary or engrafted on *herpes circinnatus*,

is the destruction of the plant ; for so long as the fungus is present, so long will there be increased flow of blood to the part, secretion of a substance favourable to the growth of the plant, and, as a necessary consequence, persistence of the conditions of hair and scalp resulting from the presence of the plant.

How can we destroy or remove the plant ? We are acquainted with various agents destructive to vegetable life. The application of any one of these to the diseased patch would no doubt quickly effect our object, were it not for the difficulty of making the parasiticide penetrate into the substance of the hair as low as its root, and pass down to the base of the hair-follicle.

Such preparations are the following : bichloride of mercury four grains, lard two drachms ; acetate of copper half a drachm, lard four drachms ; ammonio-chloride of mercury twenty grains, sulphur ointment four drachms ; strong blistering fluid ; creosote twenty drops, lard two drachms ; strong sulphuric acid, washing the part directly after with cold water ; and a saturated solution of sulphurous acid. Although any and all of these means will sometimes effect a cure, I am disposed to prefer as most uniformly successful the sulphur and white precipitate ointment. Dr. Gull, I am told, has found the strong sulphuric acid rapidly cure the disease.

Whatever treatment may be adopted, cleanliness is essential. The patches should be well washed from time to time, so as to remove the scales, and with them innumerable sporules and much mycelium. As a detergent a solution of borax will be found useful. The parasiticide ointment should be well rubbed into the part at least twice a-day.

It has been proposed to pull out the hairs from the patch ; and no doubt the success of the epilation would be marked, if it were possible to perform it. But epilation is impracticable ; the hair breaks off just above the point where it emerges from its follicle. In rare instances only can the root of the hair be extracted, and in rarer instances still can the root-sheath be got out with the hair. Blistering the part assists in the removal of the hairs. As the secretion of the hair-follicles in strumous children seems particularly favourable to the growth of the trichophyton tonsurans, cod-liver oil is useful.

It is satisfactory to know that although tinea tonsurans may be very obstinate, it always disappears after a time, and, further, that it never causes even partial baldness.

Tinea favosa, though common in Holland and some other parts of the Continent, is a rather rare disease in England. Its ordinary seat is the hairy scalp. Now and then, however, it occupies other parts.

Be it situated on scalp, trunk, or extremities, the disease is primarily seated in the hair-follicles, and is characterised by dry brimstone-yellow crusts, each crust being cup-shaped, and having a hair running through its centre. The size of the crusts varies from a mere point to half an inch in diameter. The separate crusts coalesce as they increase in size and number, and thus a large, dry, irregularly-pitted crust is formed. The crusts are buried to some depth in the cutis, so that if one be raised from its place, a depression of the cutis is exposed in which it was imbedded. The depressed surface is always redder than healthy skin ; but only here and there is the cutis denuded of its epithelial covering. Among the dry crusts are usually a few pustules. These pustules are an accidental complication indicating the coexistence of impetigo.

The crusts of tinea favosa have a peculiar foetid odour, and from the impediment they offer to cleansing the head favour the occurrence of vermin. The pediculi are found chiefly in the fissures of the large crusts. Intolerable itching is often experienced. There is a variety of tinea favosa in which the crusts are from the first amorphous, wanting in the cup-shaped character, and less bright in colour.

Microscopic examination. The pus from the pustules contains the cor-

puscles characteristic of that fluid. The dry yellow crusts are composed of the mycelium and sporules of the *achorion Schönleini*. The sporules of the *achorion Schönleini* are oval, and much larger than those of the *trichophyton*. The mycelium and the sporules can both be seen readily in the hair which runs through the centre of each dry sulphur-coloured crust.

The steps of the disease are these : first, there is thickening of the root-sheath of the hair-follicle, and accumulation of its secretion about its orifice. So long as there is nothing more than this, we are not able to say that any disease exists ; but let the sporules of the *achorion* fall on the prepared soil, and the sulphur-coloured crusts of *tinea favosa* are rapidly formed. The plant grows outwards between the layers of epithelium, downwards into the follicle, and entering the hair near to its root, shoots upwards into its substance.

The *trichophyton tonsurans*, the plant proper to *tinea tonsurans*, grows into the hair-follicle ; but its presence inflicts no permanent injury on the structures of the follicle. The *achorion Schönleini*, unless it be soon eradicated, destroys the follicle, and permanent baldness is the consequence.

Herpes circinnatus bears the same relation to *tinea favosa* that it does to *tinea tonsurans*. The secretion of *herpes circinnatus* is as favourable to the growth of the *achorion* as it is to the growth of the *trichophyton*. *Tinea favosa* is, like all the diseases of its class, contagious ; but the *achorion* requires a favourable soil for its growth. The disease rarely spreads in the hospital. The writer had a case of *tinea favosa* for some time under his care in the Hospital for Sick Children : not a child caught it till a case of *herpes circinnatus* was admitted into the same ward. On several children rings of *herpes circinnatus* soon after appeared ; and two of the children thus affected now caught *tinea favosa*, and the crusts of the *tinea favosa* occupied the centre of the patches of *herpes circinnatus*. As these cases are of interest from their bearing on the pathology of the affection, one may be quoted at length :

On the outer aspect of the right arm, just below the elbow, is a pinkish-red patch, slightly elevated, nearly circular, and five-eighths of an inch in diameter. The centre of this patch is occupied by ten or twelve crusts of *tinea favosa*, the largest not more than a line in diameter, the smallest requiring a lens for its detection. The largest are distinctly depressed in the centre, the smallest are merely yellow spots. Through the centre of each crust runs a little hair. A few white scaly-looking points are scattered around the part occupied by the crusts. The circumference of the patch is covered by pretty closely set, flattened vesicles ; the majority so small that they might escape observation, unless the part were examined with a lens.

On the right shoulder, the left upper arm, and the left leg, are patches of similar character.

Passing from the circumference to the centre of the patch are—

- 1st. A ring of the vesicles of *herpes circinnatus*.
- 2d. Scales formed by the drying of the vesicles.
- 3d. Crusts of *tinea favosa*.

Some of the crusts are mere points, the disease being limited to the very orifice of the hair-follicles. There are no pustules ; not a trace of suppuration ; a sufficient proof that the disease is not pustular at its commencement.

As without the existence of the plant *trichophyton* there could be no such disease as *tinea tonsurans*, so in regard to *tinea favosa*, were there no such plant as the *achorion Schönleini*, there could be no such disease as *tinea favosa*. The soil requires preparation ; but all the visible phenomena of the disease—those appearances which we call *tinea favosa*—are the direct consequences of the presence of the plant.

Treatment. The objects to be kept in view in the *treatment* are to remove or destroy the plant, and to improve the state of the secretions of the part which is its seat. As the subjects of *tinea favosa* are often strumous, benefit is obtained under such circumstances from the administration of cod-liver oil,

syrup of iodide of iron, calumba, rhubarb, and soda, and other remedies of the same class. But all other means will fail unless the plant be destroyed and removed. For this purpose, parasiticide substances—that is to say, substances destructive of vegetable life—are to be applied, and at the same time so much of the plant as possible removed by mechanical means.

The crusts are to be removed by a bread-and-water poultice, or, better still, by the continuous application of lint dipped in a solution of sulphurous acid. Bichloride of mercury, dissolved in water or mixed with lard in the proportion of eight grains to the ounce, and acetate of copper mixed with lard, half a drachm to the ounce, are two of the most powerful parasiticides. A saturated solution of sulphurous acid properly applied is an excellent remedy: a piece of lint dipped in the solution is to be closely and constantly applied to the affected part, and this covered to prevent evaporation by oil-silk, or by a second piece of lint spread pretty thickly with lard. If the disease be on the trunk or extremities, and the general health good, it may be rapidly cured in this manner. The girl whose case is above described was permanently cured in a few days. But if the disease be seated on the hairy scalp, and the plant has entered the hair-follicles, and shot up into the hairs themselves, considerable difficulty is experienced in bringing the parasiticides in contact with the plant, and as a consequence epilation is almost essential for permanent cure. If the hairs be pulled out before the hair-follicle is destroyed, no baldness follows. Epilation may appear to be a very painful operation, but if well performed it is not so. Each hair should be grasped with a pair of forceps adapted to the purpose just where it escapes from its follicle, and pulled sharply in the line of the direction of its insertion into the follicle. As the hairs are much less firmly fixed in their follicles than in health, epilation is so much the more easily effected. If the disease be limited in extent, no practical difficulty exists to its cure by epilation; if it occupies the whole or a great part of the scalp, the cure requires much time and great patience. So long as a sporule or a branch of mycelium remains in a hair undestroyed, so long is it certain that the disease will return.

Before epilation, l'huile de cade is by many applied to the part from which the hairs are to be removed. It is said to diminish the sensibility, and loosen the attachment of the hair to its follicle. The old pitch-cap was merely a quick mode of epilation, and not so painful as might be supposed. If herpes circinnatus be present, the extension of the ring of vesicles should be prevented, and on their first appearance the small patches of herpes should be destroyed with nitrate of silver.

Tinea favosa is the disease described by Bateman under the name of *porrigo lupinosa*. The *porrigo favosa* of Willan, Bateman, and Thompson is a species of *impetigo*. These excellent observers mistook the yellow crusts of *tinea favosa* for dried pustules.

Tinea decalvans is very readily recognised. The roots of the hairs atrophy, till at length, being smaller than their follicles, they fall out. Commencing at a point on the hairy scalp, the disease spreads circularly till a bald patch of some size is formed. Now and then, the bald patches are irregular in form; still even then the margin of the patch is usually scolloped, as though the large patch had been formed by the coalescence of several smaller patches. The disease may ultimately involve the whole scalp; nay, occasionally the hairs of the eyebrows and the eyelashes are similarly affected, and fall in like manner from their follicles. There is neither redness, heat, tenderness, nor any eruption on the bald patches; usually, indeed, the bald scalp is something paler than natural.

Tinea decalvans is common enough in children and young persons. It more rarely affects those of more advanced age. The patches from which the hair has fallen are quite smooth. The patches of *tinea tonsurans* must not be confounded with those of *tinea decalvans*. In the latter the surface of the patch is quite smooth—there is local baldness, and that is all; in the

former the hairs look as if they had been cut off just above the point at which they emerge from their follicles.

This disease is called *tinea* in deference to the statements of Bazin and others; the writer has never detected any vegetable growth on or in the hairs about to fall from their follicles. The plant, the *microsporon Audouini*, is said to be found attached to the hairs just above the surface of the scalp. The atrophy of the bulb of the hair is considered to be secondary to the action of the plant. Willan called this disease *porrigo decalvans*. It is called by some *alopecia circumscripta*.

Treatment. If the patient be pale or weakly, iron and cod-liver oil may be given. Local stimulation is, however, far more important. Tincture of iodine is a convenient stimulant; it may be applied night and morning. A saturated solution of sulphurous acid is very efficacious. It should be applied constantly by means of a piece of linen soaked in the solution, and covered with an oil-skin cap. The linen requires to be wetted many times a-day. Sometimes the saturated solution of the acid is too stimulating; and if so, it may be diluted with as much or more water—just so much diluted as that it may produce a little redness of the scalp, but no eruption. If the patches be small, tincture of iodine is the best application; when the disease is extensive and spreading rapidly, the head should be shaved, and the sulphurous-acid lotion applied. If less powerful stimulants fail, blisters may be applied. As the hair-follicles are seriously at fault, and new hair has to be formed, a cure cannot be quickly effected. The first sign of improvement is the presence of a little downy hair on the patch. This down is, after a time, replaced by better-formed hair, and this again by still more perfect hair. The baldness is never permanent.

Tinea sycosis, or *mentagra*, as it is often called, is a disease of the beard, moustache, whiskers, and inner surface of the nares, in which a little fungus finds a nidus between the root of the hair and the wall of its follicle. The plant is the *microsporon mentagrophytes*, and it makes its presence known by the inflammation it excites. The inflammation causes thickening and induration of the tissues around the follicle, and suppuration of the follicle itself. As the disease originates in the follicle, a hair may be seen to traverse the centre of each pustule. The pus and epithelium about the orifice of the follicle dry into a thick brownish scab. When the scabs are numerous, and the parts about tuberculated from the swollen and irregular induration around the follicles, the part affected with pus being supposed to have some resemblance to the pulp of the fig, the name *sycosis* has been given to it. Between the scabs are often seen little scaly particles formed of epithelium. *Sycosis* may be confounded with *impetigo*; but the induration and swelling of the tissues is trifling in *impetigo*. *Acne* of these parts also may be taken for *sycosis*; but in *acne* the induration is greater than in *sycosis*, and the suppuration less rapid. There is no vegetable parasite in the hair-follicles in *impetigo*, nor in the sebaceous follicles in *acne*.

Tinea sycosis is often a very obstinate affection.

The *treatment* of this disease is to be conducted on the same principles as those of the other affections of its class. Substances destructive to vegetable life are to be applied to the diseased skin; and as the plant is in the hair-follicles, they must be applied in a form fitted to enter the follicles. An ointment of lard and corrosive sublimate, in the proportion of a grain to the drachm, is sometimes very useful. The white precipitate ointment of the London Pharmacopœia may effect a cure. Dr. Thompson recommends strongly an ointment composed of a scruple of iodide of sulphur and an ounce of lard. Warm fomentations and poultices, by removing the scabs and allaying the inflammation, afford much relief to the patient. The condition of the digestive organs must be attended to, and purgatives, tonics, and antacids exhibited as required. A good and generous diet is usually necessary. Epilation is sometimes essential for effecting a cure.

Chloasma, or *pityriasis versicolor*, is a very common disease. Its most frequent seat is those parts of the neck, upper arms, chest, and abdomen, which are covered by the flannel jacket. The axillæ, however, usually escape. It is curious to note how often the disease is limited exactly to the parts in contact with the flannel. In such cases its occurrence is favoured by want of cleanliness.

Many people are so dirty in habit as to wear the same flannel next their skin for a week, a fortnight, three weeks, and, among the poor, even a month. And it is by no means an uncommon thing for them to wear the same flannel night and day, not once removing it from the moment it is put on till the time it is considered to be desirable to have it washed. The consequence of such habit is an accumulation on the surface of the skin of its secretion and of undetached epithelium, and the consequent formation of a nidus favourable to the growth of the microsporon furfurans. This plant finding, then, in the epithelial accumulation saturated with the secretions a fitting soil, spreads under its outer layer in all directions, and by its presence produces the pale yellowish-brown patches characteristic of chloasma. At the margin of the larger patches are numerous detached brownish-coloured circular spots. The spots are scarcely raised above the surface of the skin. Like all the other vegetable parasites, the microsporon furfurans exhibits a disposition to spread from the point on which it alights uniformly in all directions. Hence the circular form of the patches. The large irregularly-shaped patches are formed primarily by the coalescence of the smaller. If one of the brownish patches is rubbed, a number of minute scales will be detached, and the cutis underneath will be seen to be somewhat redder than the adjacent skin. The only annoyance the patient experiences is itching of the part on exercise or when heated, and the consciousness of having very unpleasant-looking skin beneath his jacket.

Microscopic examination. If one of the delicate scales from a patch of chloasma be placed in a little alkaline fluid, and examined with a magnifying power of 250 diameters, it is seen to be formed of epithelial scales studded with the mycelium and sporules of the microsporon furfurans. If to the scale water only be added, the plant will not be visible. The alkali renders the animal matters transparent, and leaves the plant unchanged. The microsporon is seated on the under surface of the epithelial scales, no part of the plant projecting beyond the margin of the scale on which it grows.

Treatment. To cure the patient, his dirty habits must be reformed, supposing him to be of such. He must change his flannel frequently, and never sleep in that which he wears during the day. He must wash daily, not merely his hands, but his whole trunk and extremities, using hot water and strong soap. After washing, he must rub the surface well with a flesh-brush, taking care that the latter is itself often cleansed. In addition to these frequent and careful ablutions and frictions, by which a large quantity of the fungus is removed, the patient should bathe the part affected with a parasiticide lotion, composed of twelve grains of bichloride of mercury to four ounces of water. The lotion should be allowed to dry on the part. A saturated solution of sulphurous acid may be applied freely with the same object, viz. to kill the fungus. A lotion of sulphuret of potassium, one drachm to the pint of water, will cure; but then it is offensive. Some consider a course of arsenic essential to the permanent cure; but it is not so.

No doubt some persons who are very cleanly in their habits, and some who are as cleanly as their clear-skinned neighbours, suffer from chloasma. One concludes, therefore, that in some instances the secretions of the skin are abnormally favourable to the growth of the fungus. In some of these cases arsenic may be of service; so too is cod-liver oil.

Phthisical people often have patches of chloasma on their chest or elsewhere. This is the result, partly at least, of want of cleanliness. Persons delicate in the chest, as they call it, are frequently afraid of washing more than face and hands. Again, they usually keep themselves closely wrapped in flannel, and

are somewhat too fearful of changing it; and, yet further, sweating, alternating with heat of skin, is common in such cases—conditions favourable to the formation of a good nidus for the microsporon furfurans.

Like all the parasitic diseases, chloasma is contagious.

With reference to the nomenclature of these diseases, characterised by the presence of vegetable parasites, it should be remembered that—

Tinea tonsurans was called by Willan and Bateman *porrigo scutulata*.

Tinea favosa was called *porrigo lupinosa*.

Tinea decalvans was called *porrigo decalvans*.

Chloasma was called *pityriasis versicolor*; while the

Porrigo favosa of the same authors was a variety of *impetigo*.

Scabies. The eruption of scabies is caused by the presence of a minute animal parasite, the *sarcoptes hominis*, in the under layer of the epithelium. The *sarcoptes hominis* has been taken from its burrow, placed on a healthy person, and the disease in that way communicated. It is by the passage of the parasite from one person to another that the disease spreads; hence the hands in the adult, and the buttocks and loins in children too young to walk, are the especial seats of the disease. In children the hands often escape; in adults the parts of the hands where the skin is most delicate are the parts first to suffer, *i.e.* between the fingers, the bend of the wrist, the root of the thumb, and the inner margin of the hand. Scabies never affects the hairy scalp or the face of the adult, and only rarely the face of the child.

The eruption appears to be produced thus: The animal bores a way through the outer layer of the epidermis, and then for some distance onward, in the softer layer of the epidermis. Immediately adjacent to the point at which the animal passes into the epidermis, a vesicle, papula, or pustule is formed. The *sarcoptes* itself is found at the end of the faint whitish line or burrow, leading from the vesicle or papula. The burrow varies from a line to an inch in length. When the disease affects the delicate skin between the fingers or toes, and continues for some time, the cuticle thickens and cracks. These cracks are very characteristic of the disease. The only disease of the skin directly resulting from the animal's presence are the vesicles, papulæ, and pustules, and the delicate line leading from a few of these. The blackish points, the linear abrasions, the broader inflamed patches, and the ulcers so common in the young child, are the consequences of injury inflicted on themselves by the patients, in their endeavour to allay the intolerable itching. Hebra has pointed out that when the paralytic are the subjects of itch, none of these severer effects of scabies are observed. The vesicles of scabies are scattered irregularly over the part affected; many of them seem buried somewhat in the skin, so that they may be mistaken for papulæ. These deep-seated vesicles are never acuminate, and there is little or no redness around them; on the apices of some of the papulæ a minute vesicle may be detected by the lens; those vesicles, the vesicular character of which is more evident, are acuminate, and may or may not have some redness around. The phlyzacious pustules often attain a considerable size.

The superficial acuminate vesicles are best seen between the fingers and toes and at the bend of the wrist, the disease being recent; the cracks in the same situations when the disease has lasted some time; the buried vesicles on the upper extremities, and where the epidermis is naturally rather thick—the burrows of the *sarcoptes* on the sides and anterior aspect of the fingers. It is a matter of some interest, as showing the accidental nature, so to say, of the eruption, to know that some good observers have recorded cases in which there were no vesicles, pustules, or papulæ, only the burrows, at the extremities of which were found the *sarcoptes*; the itching in these cases was as severe as in those attended with an eruption. In old persons, whose skins are thick and not very sensitive to irritants, the eruption is often trivial and papular in character. The disease is then not infrequently confounded with prurigo. The itching in scabies is very decided and severe, and greatly increased by

warmth. The amount of inflammation and ulceration that may accompany the disease when it affects the delicate skin of young infants is likely to lead to a mistake as to its nature. Vesicles and pustules sometimes form under the thick cuticle of the sole of the feet, and are very characteristic of the disease.

Scabies never disappears spontaneously. I have seen cases where the disease has lasted for years, its nature having been misunderstood.

Eczema often complicates scabies.

Treatment. Sulphur is the best remedy for scabies. It cures the disease by killing the sarcoptes. In the St. Louis Hospital at Paris, two hours' treatment is considered sufficient for the cure of the disease. The patient, after being well washed with soft soap for half an hour, is strongly rubbed for the same space of time over the whole surface with the sulpho-alkaline ointment of Helmerich, composed of eight parts of lard, two parts of sulphur, and one part of carbonate of potash, and directly afterwards placed in an alkaline bath. The patient's clothes are fumigated with sulphur.

The objections to this method of treatment are, that eczematous eruptions often follow its employment in persons with a delicate skin, and that the ointment stains the linen. The sulphur ointment of the Pharmacopœia does not cure so rapidly, although it does so quite as certainly as the sulpho-alkaline ointment. The great use of the alkali is to remove the superficial layer of epithelium, and so expose the sarcoptes more completely to the action of the sulphur.

Supposing that, from the position in life of the patient, it is desirable to hide the odour of the sulphur, the best scents for the purpose are the essences of bergamot and of lemons; a little bisulphuret of mercury will conceal the colour of the sulphur.

Devergie recommends, if the odour of the sulphur be highly objectionable, that the patient be placed for an hour, or an hour and a half, daily in a bath containing from two to three drachms of bichloride of mercury. Five or six baths, he says, suffice for the cure. Iodide of potassium may be substituted for the bichloride of mercury, but then more baths are required. Bazin advises, under like circumstances, that the surface be rubbed daily with an ointment composed of powdered camomile-flowers, lard, and olive-oil, in equal parts.

When scabies is present, no matter with what other eruption it is complicated, the scabies is to be first cured.

BULLÆ.

There are two genera of the diseases of the skin characterised by an eruption of bullæ or blebs, viz. pemphigus or pompholyx, and rupia.

Pemphigus is not an uncommon disease. The bullæ are very perfect. In size they vary from that of a split-pea to half an egg; the larger are not formed by the coalescence of the smaller. If there be any red margin to the bullæ, it is very narrow; often there is no redness around. In some cases the bullæ are preceded by a red spot of the same size as the coming bleb; the bulla itself having its full circumference from the first, only being less elevated than it becomes in its progress. Sometimes, however, a vesicle appears, and the bulla is formed by its extension in all directions. At first the bulla is transparent; subsequently the fluid becomes opalescent and frequently puriform; at the same time, or it may be before the fluid loses its transparency, the cuticle covering it grows opaque. In the latter case the bulla looks as though it were filled with puriform fluid, and it is only by puncturing it that the chief cause of the opacity is discovered. In cachectic and aged persons the fluid is often sanguinolent.

The fluid of the bullæ in pemphigus resembles the serum of the blood in chemical composition. It is faintly alkaline or neutral so long as it is transparent; when it becomes puriform, it is acid. After attaining its full size the bulla bursts, then the cuticle covering it falls into folds or wrinkles, and, with such portion of the contents as has not escaped, dries and forms a scab.

A few days only elapse from the eruption of the bulla to the formation of the scab. The scab or crust varies in thickness; usually it is thin, sometimes foliaceous, never very thick. After a time the scab falls off and leaves a reddish stain or scar, not a cicatrix. Now and then, when the scab is detached, a superficial ulcer is exposed. If the bleb be broken, and the cuticle removed, the surface is excoriated.

In rare cases only one bulla is present at the same time; bulla after bulla on different parts of the surface following each other in succession. This is the pemphigus solitarius of Willan. Usually there are many bullæ present at the same time, and they are either scattered or grouped. When many are seated near to each other, the skin between is usually red, and the lymphatic glands to which the lymphatics of the part lead enlarged and tender. This affection of the glands is out of proportion to the inflammation about the bullæ. The glands rarely, if ever, suppurate. The bullæ of pemphigus are more common on the extremities than elsewhere; but they are often seen on the trunk, genital organs, and face; less frequently on the hairy scalp. Rayer and A. T. Thompson say they have seen bullæ in the mouth and on the velum palati. There seems to be no foundation for the assertion that they are found on the gastro-intestinal mucous membrane.

When present on the soles of the feet or palms of the hands of infants, they are evidence of constitutional syphilis. Pain and heat of the part accompany the development of the bullæ.

Varieties. 1. Pemphigus may occur as an acute disease in young subjects otherwise healthy. The eruption is preceded for two or three days, and is accompanied by febrile disorder more or less decided. Under these circumstances, the disease runs a course of from one to four weeks. When prolonged for a month, two or three crops of bullæ follow each other; when over in a week, the disease ends with the scabbing of the first eruption.

The occurrence of idiopathic acute febrile pemphigus has been denied by some writers. "That there is indeed such febris bullosa cannot henceforth well be doubted. Still Rayer's observation, that it is a rare disease, appears correct, since many physicians of large experience have never seen a case, *e. g.* Hebra. I also have never witnessed the acute form."^{*}

2. Persons of damaged health and old people also suffer from a severe febrile form of pemphigus, which runs a quick course.

3. More commonly, pemphigus occurs as a chronic disease, lasting months, or even years. This form of the disease is seen in persons of average health, in the cachectic, and at all ages, from childhood to extreme old age. It is unaccompanied by febrile symptoms; but as the chronic course the disease runs depends not on the duration of individual bullæ, but on the repeated eruption of new bullæ, we observe, when they come out in crops, that a little headache, sense of languor and malaise, and trifling febrile disturbance, precede the eruption.

Synonyms. The names given by writers to the above varieties are founded, 1st, on the duration of the disease: acute pemphigus, febris bullosa, chronic pemphigus, pemphigus diutinus; 2d, on the presence or absence of febrile symptoms: pompholyx pyreticus, pompholyx apyreticus; 3d, on the degree of severity of the general disease: pemphigus benignus; 4th, on the number of the blebs and their arrangement: pemphigus solitarius, pemphigus en groupes.

Nature and seat. The local affection in pemphigus is secondary to some constitutional or general condition. This is especially clear in the acute febrile variety; for in that form well-marked and sometimes very severe pyrexial symptoms, headache, and languor precede the eruption for two or three days. No doubt certain other symptoms are the direct consequences of the local affection; *e. g.* irritation from sleeplessness, derangement of the digestive organs. Of the nature of the general disease to which the local affection is secondary, we know no more than we know of the nature of the

* Gustav Simon, *Die Hautkrankheiten*, p. 194.

fever which precedes the eruption of small-pox. The fluid of the bullæ is poured out from the surface of the true skin, and collects under the epidermis. There is no evidence to show that the bullæ originate in any of the special structures of the skin.

The lesions found after death have been various evidences of inflammation of the intestinal and urinary mucous membranes, and in almost every case fatty liver.

Prognosis. Pémphigus is always a grave affection. To the cachectic and aged it is often fatal. As a chronic disease it is most obstinate.

Diagnosis. Varicella, herpes zoster, and rupia are the diseases said to resemble pemphigus. But there is little danger of confounding it with any other disease when the bullæ are present; their large size, the small amount of inflammation around them, the absence of any thing which can be called a base, and their irregular distribution, are peculiarities which permit no mistake in diagnosis. The fever which in rare cases precedes their eruption has no diagnostic characters.

Cause. Of the causes of pemphigus very little is known. Mental distress, exposure to wet,—e. g. prolonged stay in water,—and derangements of the urinary organs, have all been considered to be predisposing causes. Attempts have been made several times, without effect, to communicate the disease by inoculation of the fluid from the bullæ. Scharlan, however, succeeded in producing bullæ by inoculating himself from an infant four days old, suffering from pemphigus. The child appears to have communicated the disease to several persons.* In this case the disease was probably of syphilitic origin. Febris bullosa, as acute pemphigus was formerly called, is said to have occurred as an epidemic, and then to have spread by contagion.

Treatment. Local. Directly a bulla is detected, the cuticle covering it should be punctured with a fine needle. This stays its increase in size. Care must be taken to prevent the cuticle being rubbed off, as the surface exposed will be excoriated, painful, and tender. Dr. A. Todd Thompson recommends that the parts, after the escape of the contents of the bulla, should be pencilled with a solution of nitrate of silver, in the proportion of a drachm to a fluid ounce of water, acidulated with ten or twelve minims of dilute nitric acid. This solution hardens the cuticle and forms a good covering, he says, to the tender surface beneath it. All other local means are useless until scabs form; and then, if these are thick, and several are in juxtaposition, with the skin beneath ulcerated, a poultice of bread and water may be applied with advantage. If the ulcers do not heal after the separation of the crusts, they may be stimulated by nitrate of silver.

The general treatment varies with the state of the constitutional disturbance and the general powers of the patient. If the patient be a strong young adult of temperate habits, the pulse full and hard, and the febrile disturbance considerable, benefit will follow abstraction of blood from a vein; but cases requiring, or even permitting, blood-letting, are rare. Rest, mild aperients, and spare diet are usually sufficient, even in the acute febrile form, to bring the case to a successful termination.

When the disease occurs, as is more common, in the aged or the cachectic, bark and ammonia, quinine and the mineral acids, and generous diet, with a moderate supply of alcoholic stimulants, are indicated. Opiates at bedtime are frequently required.

In the chronic apyrexial form the treatment must be regulated by the general state of the patient.

Arsenic exerts little or no influence. Iodide of potassium is of use only when the disease is of syphilitic origin. Cod-liver oil is sometimes beneficial. Tepid baths have been of service; but occasionally fresh crops of bullæ have followed directly on their employment. If tepid baths are taken, gelatine should be dissolved in the water. Alkaline baths have been recommended

* Caspar, *Wochenschrift für die gesammte Heilkunde*, p. 186, 1841.

for allaying the irritation of the surface. When successive crops of bullæ occur on the same part, the surface at the moment it is free from eruption may be painted with a solution of nitrate of silver sufficiently strong to blacken the surface.

A milk-diet has sometimes succeeded when other means have been useless. Cazenave says that he has often obtained good results from giving the patient acorn-coffee.

A case was some time since under the care of the author which resisted all remedies. The child would appear to be nearly well, and then again a new crop made him as sad an object as before. When admitted into the Hospital for Sick Children he had already been suffering for more than two years, and had been into more than one hospital, and under the care of several private practitioners, the parents being well-to-do in the world. He took measles while in the hospital, and from that time was free from pemphigus. There was no return of the affection for a year, *i. e.* when the last report of him was received.

Rupia. The bullæ in rupia are small and somewhat flattened; their contents very soon become opaque, and are not unfrequently sanguinolent. They are seated on a *very* slightly-raised base, and are surrounded by a distinct inflammatory flush. A thick dark-coloured rough scab or crust is formed by the drying-up of the bullæ. If not forcibly removed, the scab remains attached for a considerable time. An ulcer, often deep and intractable, is exposed on the removal of the scab.

Sometimes the ulceration extends beyond the margin of the first scab before it is detached, and then a scab forms under the primary one, and of larger circumference; and this process is repeated until a conical crust, of considerable thickness in the centre, and an inch or more in diameter, is constituted. This crust is commonly and aptly compared to a limpet-shell. This variety of rupia is called *R. prominens*. It is evidence of a profound constitutional cachexia, in the majority of cases, if not in all, of syphilitic origin.

In other cases of rupia the ulceration is the marked feature. The scab is imperfect, and when detached an unhealthy-looking and spreading ulcer is exposed. This is *R. escharotica*. Sloughs occasionally form on the floor and at the margin of those ulcers; and then the disease has been mistaken for pemphigus, and called *P. gangrenosus*. In rupia simplex the crusts are of moderate thickness, and the ulcer which follows is neither deep, nor does it exhibit any tendency to spread. Neither scab nor ulcer is remarkable. Hebra holds that *R. simplex* always precedes *R. prominens*, *i. e.* that the latter is but an advanced stage of the former; and G. Simon thinks he is right. In fact, there is no line of demarcation to be drawn between the varieties of rupia. The one passes by insensible degrees into the other.

Rupia is a chronic disease, and is usually limited to the limbs and loins. It is not contagious, and is almost limited to persons of damaged health. It is common in the cachectic state of the system which so often follows the acute specific diseases. Purpura hæmorrhagica is an occasional complication. Rupia prominens is frequent in the advanced stages of constitutional syphilis. *R. simplex* is common in children of six or seven years of age. *R. escharotica* and *gangrenosa* are limited to young children; the two latter are rare diseases. It is not known what special structure of the skin is primarily affected in rupia.

Rupia is more like to ecthyma than to any other disease of the skin. In ecthyma there are pustules; in rupia bullæ; but then the serum of the bullæ is soon replaced by a puriform fluid. The red base of rupia is much less raised and decided than that of ecthyma; the scab is thicker and not imbedded, and the ulceration following the scab is greater.

Treatment. Local. The bullæ of rupia should be punctured as soon as they arise. When scabs are formed, they should be removed, and the ulcers

dressed with some slightly-stimulating application. A solution of nitrate of silver is frequently of much benefit.

General. The subjects of rupia are always cachectic or debilitated. Tonics, especially quinine, are indicated. Decoction of cinchona, with mineral acids, will sometimes agree with the patient when quinine will not. The tincture of serpentaria is sometimes very useful in rupia. The diet should be generous. Wine is generally required, and is borne well even by children.

PUSTULÆ.

Impetigo, one of the most common of the diseases of the skin, is characterised by an eruption of small pustules, followed by thick rough crusts. The pustules of impetigo are of two kinds: the one pale-yellow, flat or rounded on the surface, very slightly elevated above the cutis, and having comparatively little redness around; the other very small, acuminate, and having a red and somewhat elevated base, disproportionately large in comparison with the suppurating points; the latter are achores, the former psydracia. Achores are common on the face of children; psydracia on the scalp and other parts covered by long hair.

The pustules of impetigo are sometimes scattered at a distance from each other, sometimes grouped into clusters on a red ground; and the red ground in the latter case may precede the eruption of the pustules, as it does the eruption of the vesicles in herpes.

The crusts that follow the pustules are always thick; those that succeed to the achores are transparent and tenacious, and resemble in appearance inspissated honey and some kinds of gum; those that succeed the psydracia are either small, separate, and dry, or, covering some extent of the surface, are thick, rough on the surface, and particularly solid.

The lymphatic glands, to which the lymphatics of the part lead, are invariably enlarged in impetigo. This enlargement of the lymphatic glands is not limited to those cases in which there is a considerable amount of inflammation or a copious eruption. A child brought to the physician because of the enlargement of one or more of the lymphatic glands of the neck will frequently be found to have an unsuspected spot or two of impetigo of the scalp. The achores and psydracia are alike accompanied by this glandular affection.

In very exceptional cases the suppurative inflammation destroys the root of a few of the hairs, and thus a very small bald spot remains after the crusts have separated. In the vast majority of cases not one of the roots of the hair is destroyed. A certain amount of itching frequently accompanies impetigo; in extremely rare cases the pustules are exquisitely painful to the touch, and in still rarer cases intractable ulceration follows the separation of each crust.

The pustules characteristic of impetigo are produced by inflammation of the hair-follicles, terminating in suppuration. Impetigo is thus anatomically and pathologically defined as suppurative inflammation of the hair-follicles. The difference between achores and psydracia is probably due to the anatomical differences of the hair-follicles of the face and those of the perfect hair-producing parts or on the relative proportions of the hair-forming follicle proper and of the sebaceous structures which enter into the composition of the perfect hair-follicle. On the hairy scalp the achores are almost limited to the occipital region, and especially to that part corresponding to the interval between the insertion of the muscles.

Achors are far more common in the child than in the adult.

The admitted varieties of impetigo are due—to the seat of the disease (thus we have impetigo faciei and I. capitis);—to the close approximation of the pustules on a defined inflamed surface, or to their being scattered at a distance from each other, the space between being pale (these differences have given origin to the names I. figurata and I. sparsa);—to the character of the inflammation which precedes and accompanies the acute development of the pustules of certain cases of I. figurata (hence the variety I. erysipelatoides);—

to the thickness and extent of the crust which follows (when the face is covered by a thick crust, the variety is *I. larvalis*; when a thick crust covers a large surface of an extremity, it is *I. scabida*—this latter is limited to adults: “In the lower extremities,” Bateman observes, “the disease is most severe and obstinate; is ultimately conjoined with anasarca, and often produces severe ulceration;” when the crusts are small, dry, and adhere for some time to the hair after they have separated spontaneously from the cutis, the disease is termed *I. granulata*);—to intractable ulceration following the pustules (it is doubtful, as has been suggested by Cazenave, whether *I. rodens*, as this variety is named, would not more correctly be placed as a species of *lupus*);—to the duration of the disease, *e.g.* *I. acuta*, *I. chronica*. Acute impetigo is not usually preceded by any great constitutional derangement. An inflamed patch pretty well defined precedes the eruption of the pustules. Acute impetigo is always also *I. figurata*, though *I. figurata* is sometimes a chronic affection. The duration of acute impetigo is from two to three weeks. Chronic impetigo sometimes lasts for years. The two most obstinate forms are impetigo sparsa of the beard, whiskers, moustache, and inside of the nares; and impetigo scabida of the lower extremities. In the former case the duration is due to the repeated eruption of fresh pustules; in the latter to the continuance of the formation of pus under the old thick crust. No disfigurement of the face results from the most severe impetigo. The crust after a longer or shorter time separates, leaving merely a reddish stain, which quickly disappears.

Willan figures six varieties of his genus *porrigo*, of these—

P. larvalis and *P. favosa* are merely varieties of impetigo.

Porrigo furfurans is a species of eczema.

Porrigo scutulata is *tinea tonsurans*.

Porrigo lupinosa is *tinea favosa*, and

Porrigo decalvans is *tinea decalvans*.

Bateman's description of *porrigo scutulata* is most confused; it certainly does not apply to Willan's figure. The latter is a faithful portrait of a common disease; the former applies to no known disease of the scalp, but to separate stages of many diseases having no relation chronologically or pathologically to each other. No age is exempt from impetigo, only *I. faciei* and *I. capitis* are more common in children than in adults; while impetigo of the extremities is far more frequent in adults.

The inflamed lymphatic glands occasionally suppurate in children of a strumous diathesis, and when the seat of tubercle.

The characters by which *tinea sycosis* or *mentagra* is distinguished from impetigo are well given by Cazenave.

“When impetigo,” he says, “is limited to the upper lip or chin, it may be mistaken for sycosis; but in the former the pustules are small, arranged in groups; they suppurate completely, and give rise to thick crusts: while in sycosis the pustules are distinct; they suppurate to a small part of their extent only—a sixth or eighth, for example; they give rise to a dry, hard, black scab, which is subsequently, as it were, suspended on the middle of the hair; and finally they are succeeded by tubercular indurations, which constitute a secondary phenomenon of the greatest importance.

The pustules of *ecthyma* are larger and seated on a base. The crusts of *tinea favosa* are dry, of peculiar shape, and a microscopic examination shows their vegetable nature. The vesicles of eczema have no connexion with the hair-follicles, though the inflammation may involve the hair-follicles of the part, and so eczema and impetigo be combined as in one variety of eczema impetiginodes. The crusts of eczema are thin and pale, and when they crack, oozing of a thin alkaline fluid takes place. The pus of impetigo is slightly acid.

Impetigo appears to be contagious. It is very common to see several children in the same family suffering at the same time. It does not spread, however, as *tinea tonsurans* so often does, through a large assembly of children, *e.g.* a

school. Impetigo evidently spreads by contact, and the pus cannot be wafted, as the spores of the trichophyton can, from one to another. The usual medium of conveyance of the pus of impetigo from one child to another is some article of wearing-apparel, *e.g.* a cap or bonnet. Children suffering from impetigo of the head or face often have impetiginous pustules on their fingers from picking the parts primarily affected. Cazenave denies any form of impetigo to be contagious. Willan and Bateman thought that form alone contagious which is characterised by the eruption of *achores*. Dirt is a very common exciting cause of impetigo, so also are sugar and stone-dust; the foreign particles collect in the orifices of the hair-follicles, and suppurative inflammation of the follicles is the result. Impetigo shows no special tendency to affect the weakly or the strumous, and is certainly rare in the rickety. It is an infrequent syphilide.

Treatment. In the acute form, a mild aperient, salines, and a simple unstimulating diet, with tepid water as a local application, are generally all the remedies required. When the disease has lasted some time, all crusts must be removed, either by the steam of hot water, or by bread-and-water poultices. It is frequently necessary to remove the hair in order to get the crusts away. The head cannot be shaved; but with a pair of fine scissors the hair can be cut close to the scalp. Patience is needed for this purpose, if the greater part of the scalp be affected. After the removal of the crusts, spermaceti ointment or washed lard, or sweet-oil and soap and water, night and morning, often suffice to effect a cure of masses of most repulsive-looking disease. Should these means fail, and new pustules continue to appear, a brisk mercurial aperient, *e.g.* calomel and jalap, or calomel and colocynth pill, followed by a grain of quinine three times a-day, with ten or fifteen minims of dilute sulphuric acid, will quickly bring the great majority of cases to a successful end. Quinine often seems to act almost as a specific. After the separation of the crusts, a stimulating ointment is sometimes required to prevent the continuance of suppuration. Unguentum zinci; ung. hyd. nitratis; ung. hyd. nit. oxid.; ung. sulph. ioxid.; and ung. sulphuris hypochloritis, are all occasionally useful, and one will sometimes answer when the others have failed, and without the reason being apparent.

Several doses of alterative aperient may be required in the course of the treatment. In obstinate cases the waters of Harrogate and those of Aix-la-Chapelle have been found of much service. In impetigo of the parts on which the whiskers, beard, and moustache are seated, and of the inside of the nares, epilation is often essential for a cure. The moment the slightest swelling or redness is seen at the point where a hair emerges from the skin, it should be removed. The inner root-sheath comes away with the hair; and if examined microscopically, the epithelium thus detached is found to be swollen; and often where no trace of suppuration is visible externally, pus-globules are found between the hair and the inner root-sheath. When the hair is pulled out, the pustule aborts, as it is termed. The iodide-of-sulphur ointment, and a lotion composed of bichloride of mercury two grains, and bitter-almond emulsion one ounce, are the best local applications. Care must be taken to prevent children tearing off the scabs with their nails. The parts itch and feel stiff; and consequently it is with difficulty children are kept from affording themselves temporary relief by picking and scratching the part.

Ecthyma. The pustules by which ecthyma is distinguished are the phlyctenaceous. They are large; rarely, however, exceeding a pea in size; with red, moderately-elevated, and hardish base. Each pustule is followed by a brown scab, which is very adherent to, and somewhat sunken or imbedded in, the hard base. The scab forms two or three days after the eruption of the pustule. When the crust separates, a deep red stain, a small ulcer, or a cicatrix remains.

Ecthyma runs an acute or a chronic course; the former is, however, comparatively rare.

The acute form is preceded by slight constitutional disturbance, loss of appetite, and deranged alvine secretions; rarely by febrile symptoms. The pustules are generally limited to a small part of the surface; the shoulders and neck are their most common seat. A sharp, burning, pricking pain often precedes the eruption of the pustules. In very rare cases several of the pustules coalesce. The lymphatic glands to which the lymphatics of the part lead are usually enlarged.

The duration of acute ecthyma is one to two weeks. This is the ecthyma vulgare of Willan.

The pustules of chronic ecthyma are scattered at some distance from each other. They are most frequently seated on the extremities, now and then on the extremities and trunk; and in infants they are seen also on the hairy scalp. The long duration of the disease (several months) is due to the eruption of crop after crop of pustules. When the disease affects persons of broken-down health, the pustules are often filled with a reddish sero-purulent fluid; the areola instead of being red is dusky or purple; and ulceration of an unhealthy character follows the separation of the scab: this is *E. cachecticum*.

No variety of ecthyma is contagious.

Chronic ecthyma indicates a low state of the constitutional powers; and *E. cachecticum* occurs only in the aged and those exhausted by bad diet, over-exertion, mental distress, and other depressing causes. *E. cachecticum* is sometimes accompanied by purpura hæmorrhagica, and then the areola is purple. This variety has been called *E. luridum*.

Ecthyma chronicum occasionally follows the acute specific diseases. Pregnancy is said to be a predisposing cause of the disease. It is one of the most common of the syphilides.

Ecthymatous pustules are produced by the application of various irritants to the surface. The grocer's itch, as it is called, is produced by the irritation of sugar. Stone-masons now and then suffer from the same disease. The well-known pustules that follow the inunction of tartar-emetic ointment are examples of ecthyma; only the pustules resulting from the application of this agent are umbilicated.

Scabies is often complicated, especially in young children, by large ecthymatous pustules; as are also, though much less frequently, prurigo and lichen.

The special structure of the skin which is primarily affected in ecthyma is unknown. Bielt said that the inflammation originates in the sebaceous follicles: Hilbert and G. Simon, that when tartar-emetic is applied to the skin, the orifices of the hair-follicles are first affected; and they attribute the umbilication to the tying-down of the centre of the pustule by the hair-follicle.

Treatment. In the acute form of ecthyma little is required to be done. One or two doses of alterative aperient, followed by simple salines; a simple but not too low diet; and tepid water frequently applied to the inflamed part, are all that are necessary and useful.

In the chronic forms the health is generally and sometimes very much deranged; the patient weak and exhausted. Generous diet, moderate quantities of wine, quinine or bark, and the mineral acids, serpentaria, and cod-liver oil, and steel, are one or all necessary to effect a cure. Daily tepid baths are useful. Taraxacum and sarsaparilla, with nitro-muriatic acid, seem occasionally to be of much benefit. Opiates are sometimes required at night.

PAPULÆ.

Strophulus, or red gum, as it is vulgarly called, is a common papular disease proper to children from birth to the end of the first dentition. It is characterised by the eruption of small papulæ, red or paler than the healthy skin, scattered or grouped, and attended by trifling itching.

Many writers on diseases of the skin consider strophulus and lichen to be the same disease.

Several varieties have been described, and most admirably figured by Willan. When the papules are scattered over the skin with small red spots

interspersed among them, the disease is called *S. intertinctus*. When the papules are crowded into groups, and the skin between is more or less red, it is *S. confertus*. "Sometimes," Bateman says, "though rarely, a variety of the *S. confertus* appears on the legs, spreading upwards even to the loins and navel, producing a general redness of the cuticle (not unlike intertrigo), which cracks and separates in large pieces, occasioning much distress to the child. It is liable to recur at short intervals for the space of two or three months." It is in children of seven or eight months old that this severer form of *S. confertus* occurs. When, for three or four weeks circular patches of papules appear in succession, each patch lasting four or five days, the disease is *S. exfoliatus*.

Strophulus candidus is the name applied to an eruption of white, rather large papules, which appear occasionally on the loins, shoulders, and upper arms of children of about a year old. There is a danger of mistaking the hard pale elevations produced in some children by the bite of a flea for this disease; a vesicle sometimes results from the bite of the same animal.

Strophulus albidus is a rare disease. It is doubtful if Bateman (judging from his description) ever saw a case. Willan's figure is perfect. The so-called papules are really sebaceous follicles, distended by their secretion. The small elevated opaque dead-white spots scattered in numbers over the face are so striking in appearance as at once to rivet the attention.* Willan's *strophulus albidus* is, then, a form of acne. Hebra it was who pointed out the real nature of this affection.

Strophulus is a disease of no practical importance. It is not contagious. It generally depends on some disorder of the stomach and bowels of the child; this being itself often secondary to dental irritation, or to improper diet.

Treatment. A knowledge of the causes of *strophulus* points to the treatment. A gentle antacid aperient, as rhubarb and magnesia with an aromatic; or an antacid without any aperient, as the *mistura cretæ*, should be given; attention should be paid to the diet, which is so often faulty in the child, and the use of the gum-lancet may be required. The eruption is of use, by pointing the attention to some error which, if allowed to go on uncorrected, might lead to more serious trouble. It is only in the gravest form of *S. confertus* that occasional bathing with faintly alkaline gelatine water is required.

Lichen. The papulæ of lichen are very small solid elevations of the cutis, perceptible to the touch, redder than the adjacent skin, which cannot be even temporarily removed by pressure, though they may be made for the instant to disappear. The papules itch and tingle. As the redness fades, and the papules disappear, trifling desquamation of the cuticle over them takes place. Lichen commonly affects a limited part of the surface only, *e. g.* the hands, forearms, trunk, face. The back of the hands and the outer aspect of the forearms are common seats. The papulæ are generally arranged in groups.

Lichen occurs in an acute and in a chronic form. Lichen simplex is accompanied, and sometimes preceded, by trifling febrile disturbance. The papules are bright in colour, and appear first on the face and arms, then extend to the trunk and lower extremities; it is an acute affection, lasting from ten to twenty days. It has been mistaken for measles and for scarlet fever. Lichen simplex occasionally returns at long intervals in the same individual.

Lichen *circumscriptus*, *L. urticatus*, and *L. lividus*, may be regarded as chronic varieties of lichen simplex.

In lichen *circumscriptus* the papulæ are arranged in irregularly circular groups. As those first evolved fade, others appear at the margin of the patch; in this way the disease may be prolonged for many weeks. Lichen

* In University-College Museum there is an excellent wax-model, by Mr. Tuson, of the face of a child suffering from this disease. It was made from a patient of a writer's.

gyratus, in which the papules are arranged so as to form a twisted band, is probably a form of lichen circumscriptus of syphilitic origin.

Lichen lividus is seen in old persons, and chiefly on the lower extremities. The papules are dusky red, or livid, and frequently purpuric spots are interspersed among the papules. Hebra considers it to be a species of purpura, and calls it purpura papulosa.

In lichen urticatus the more permanent papules are preceded by small wheals; the papules becoming apparent as the wheals subside. The papules are throughout the whole course of the attack larger than in any other variety of lichen. Hebra and G. Simon consider it to be a variety of urticaria, and call it urticaria papulosa.

Lichen pilaris is distinguished by the passage of a hair through the centre of each papule. It is probable that it would, as G. Simon has stated, be more correctly described as a variety of acne.

Lichen agrius is a much more serious variety. A considerable amount of local inflammation attends the eruption of the papules, which are usually limited to circumscribed patches of some extent. The heat, tingling, and itching are very troublesome, and the scratching to relieve the last-mentioned symptom increases the local inflammation. Warmth and internal stimulants, alcoholic or other, increase the itching. Lichen agrius may disappear in a fortnight or three weeks; usually, however, it runs a chronic course, crop after crop of papules appearing on the inflamed patch. Ultimately the skin of the part becomes thickened and cracked; a serous oozing may take place from the surface abraded by the nails, and suppurative inflammation may be set up, and then crusts of various degrees of thickness are formed on the surface. Lichen agrius in this state may be mistaken for psoriasis, for eczema, or for eczema impetiginodes; and it is only by the history, and by a careful examination of the margin of the patch, that the primary nature of the affection can be determined.

The prickly heat of hot countries is merely an aggravated form of lichen simplex. It is called lichen tropicus.

Lichen is not contagious. Persons of a nervous excitable temperament are specially liable to it. Women more frequently suffer than men. It is more common in spring and summer than in autumn or winter. Some derangement of the stomach or intestines is usually connected directly with the attack.

The investigations of Gustav Simon seem to prove that the papules of lichen, strophulus, and prurigo are not, as some have asserted, the papillæ of the skin inflamed or enlarged. They have no connexion with the papillæ; but are produced, according to the same observer, by the effusion of serosity into the substance of the skin. Lichen, strophulus, and prurigo are considered by Cazenave to be primarily lesions of sensibility—true nervous affections; the degree of itching bearing, he says truly, in many cases no relation to the number of the papules.

Treatment. A mercurial at bedtime, followed by a saline aperient in the morning, once or twice a-week, a carefully regulated, simple, unstimulating diet, the avoidance of heating exercises and clothing, a well-ventilated room, and a gelatinous or mucilaginous bath every night to allay irritation, will bring the majority of cases of lichen to a favourable termination. When the inflammatory symptoms have been reduced, and the disease has assumed a chronic form, arsenic will effect a cure. Fowler's solution (liquor potassæ arsenitis) in five-minim doses may be given three times a-day. Sulphur-baths have proved useful in some cases. It is rarely that local stimulating applications are of service. Ointment containing calomel and camphor, and iodide of mercury, are recommended by Rayer; but certainly prove injurious in the great majority of cases which seem best suited for their employment.

Bark with dilute sulphuric acid, and a generous diet with wine, are the proper remedies in lichen lividus.

The most obstinate forms of lichen are *L. pilaris* and *L. urticatus*. In the treatment of the former the inunction of lard every night, followed by an

alkaline bath, soap and water, and friction, are most useful. Sponging the parts with vinegar and water, or lemon-juice, will sometimes allay the intolerable itching in *L. urticatus*. The subjoined lotion is recommended by Dr. Thompson for the same purpose :

R Acid. hydrocyan. dil. ʒjss. ; potassæ liquor. ʒj. ; aq. rosæ ʒvss. M. This lotion is to be applied to the part when the itching or pain are troublesome.

Prurigo is characterised by a scattered eruption of very slightly raised, flat, and rather broad papulæ, differing little, if at all, from the colour of the skin. These papules are the seat of troublesome itching. It is sometimes very difficult to detect the papules in consequence of their colour, their flatness, and their breadth. Sometimes they appear, as it were, buried under the cuticle, and the papules which can be discovered by the most careful examination are often very few compared with the severity of the itching. Stimulating drinks, spices, heating exercise, trifling contact of the clothes, and change of temperature increase this most troublesome symptom. Sometimes the patient, comparatively free during the day, no sooner is warm in bed than the itching becomes so intolerable as altogether to prevent sleep. The excessive itching of the papules never fails to lead to their apices being torn by the nails. Blood and serosity ooze from the abraded surface, and a little black crust occupies the summits of many of the papulæ. The lines of abraded cutis, so common in scabies, are comparatively rare in prurigo. In the latter it is the papule itself which is torn. When the itching is accompanied, as it sometimes is, by a sensation as of insects crawling over the part, the disease is called prurigo formicans. This is a most obstinate and severe variety. Wheals of urticaria occasionally appear when the part is rubbed or scratched violently. Prurigo is common in the aged ; the itching being most constant and severe, the patient having little rest day or night. When prurigo occurs in old people, it is called *P. senilis*. By the irritation and want of sleep it occasions, *P. senilis* has sometimes shortened life. It is in old persons especially that the papulæ most easily escape detection. Prurigo formicans and *P. senilis* are usually very obstinate, lasting months and even years. When the itching is moderate in severity, as is not infrequently the case in young persons, the disease is *P. mitis*. This variety disappears in from a few hours to a few days.

There is no line of demarcation to be drawn between these three varieties of prurigo. The greater or less degree of itching and the age of the patient are very insufficient grounds for the foundation of species. Hence it has been proposed to divide prurigo into general and local prurigo.

The shoulders, neck, and outer aspect of the arms, are the most common seats of prurigo.

Old persons who suffer from prurigo are also frequently the subjects of lice ; and it has been supposed that the condition of skin on which the prurigo depends is favourable to the propagation of the lice. G. Simon, on the contrary, thinks that it is in many cases the rubbing and scratching of the skin consequent on the presence of the lice which induces the papular eruption. No doubt the want of cleanliness, so common in old age, is a cause for the presence of the parasite and of the eruption.

The papules of prurigo bear a close resemblance to those of scabies ; and cases of scabies, in which vesicles are few and not very perfect, have repeatedly been mistaken for prurigo. Bateman says *P. mitis* often terminates in scabies ; he might more correctly have said scabies is often mistaken for prurigo. "As to the changes of the skin in prurigo, I," writes G. Simon, "endeavoured to satisfy myself by the examination of papules, which I cut, with a small piece of the adjacent skin, from living people ; and I found exactly the same state as in lichen. The epidermis was not detached, the papillæ of the skin were not enlarged, and the fibres of the cutis were unchanged." He concludes that the papule in prurigo, as well as in lichen, is produced by the presence of serosity in the substance of the skin at this spot. If a papule of

prurigo be punctured with a fine needle and then compressed, a clear fluid oozes from the wound; if a papule of lichen be punctured with equal care, blood escapes. Simon attributes the difference to the greater vascularity of the papules in lichen, and the consequent impossibility of not puncturing a vessel. The little serosity that would otherwise be visible is concealed by the blood.

Prurigo, like lichen, is considered by Cazenave to be a disease of sensibility. Of the origin of the nervous affection, nothing is known. The retention of some of the urinary constituents in the blood has been stated, but hitherto without proof, to be a cause of prurigo. The itching of the skin in jaundice is familiar to all; and in some cases in which that symptom has been most marked, a papular eruption has been present. Whether in these cases the papular eruption was the consequence of the scratching, it is impossible to say. The subjects of prurigo often suffer from hæmorrhoids.

Treatment. If the patient be young and strong, the diet should be simple and unstimulating, and the bowels kept freely open by such a mixture as the following, taken two or three times a-day: $\mathcal{R}$ Magnes. sulph. ʒjss.; acid. sulph. dil. mxv.; inf. gentian. co. ʒjss. misce. A dose of calomel and colocynth, or blue-pill and colocynth, should also be given at bedtime once or twice a-week. Tepid alkaline baths should be used every other night. Sulphur-vapour baths are useful when aperients are no longer indicated by the pulse and general state of the patient. Sea-bathing has sometimes effected a cure.

In the aged, and in young persons of broken health, good diet and even wine are required. Tonics, especially quinine or bark with mineral acids are useful. Frequent washing with soap and water, and daily change of body-linen, are essentials. Tepid alkaline baths and sulphur-vapour baths are also of much service. Diuretics and cholagogues have been given when the disease has been supposed to depend on the retention in the blood of the urinary or hepatic secretions.

Cazenave says, that since lichen and prurigo are really true neuralgic affections, they should be treated as such. And he adds that the practical results he has obtained afford fresh proof of the correctness of his views as to the nature of these most troublesome affections. "In the majority of cases the employment of antispasmodics or of antiperiodics suffice," he says, "to modify completely the hyperæsthesia. I have had recourse," he adds, "with happy results to ammoniacal sulphate of copper, to datura-stramonium, to extract of aconite." The last he gives thus: $\mathcal{R}$ Extract. aconit. gr. xv.; conf. rosæ q.s. ut ft. pil. xx. One pill night and morning. Sulphate of quinine he gives in doses of from 3 to 5 grains per diem, and continues it for one or two weeks. Of Fowler's solution (liquor potassæ arsenitis), in common with all writers on this subject, he speaks in the highest terms; but he considers that it acts, not only by modifying the action of the skin, but also as an antiperiodic.

Local prurigo. There are many species of local prurigo, but they differ only in their seat: thus there are *P. podicis*, *scroti*, *pudendi*, *præputii*, *urethralis*, &c., according to the part affected.

Local intolerable itching is always called prurigo; but it is by no means always the consequence of a papular eruption. Itching of the anus and of the labia pudendi is a common consequence of congestion of the large veins of the part, of hæmorrhoids, of ascarides in the rectum, of an overloaded lower bowel, of the early stage of cancer of the uterus and lower bowel. Local eczema is a common cause of intense itching.

Treatment. Cleanliness and the avoidance of scratching are the first essentials to a cure. If the anus be the seat of the trouble, it should be washed after stool and then carefully dried. The liver and bowels should be freely unloaded, in order that all congestion of the parts due to impediment to the onward flow of the blood in the portal vein may be removed. Leeches to the anus are often useful when it or the parts in its vicinity are the seat of the prurigo. Tepid water, or lotions containing an alkali, opium, prussic acid, acetate of lead, calomel and lime-water, acetate of ammonia, vinegar, have all been used with advantage, and have all failed in other cases to afford

relief. The bichloride of mercury and lime-water, two grains to the ounce of lime-water, is one of the most efficacious local applications. Ointments containing lead, nitrate of mercury, or ammonio-chloride of mercury, sometimes check the itching when the lotions recommended have proved useless. The patient should always keep the preparation which answers best by his bedside, so that when the heat of the bed renders the itching severe, he may bathe or anoint, instead of scratching, the part. When eczema is the cause of the itching, a solution of nitrate of silver and the ung. sulphuris-hypochlor. are the most frequently successful applications.

SQUAMÆ.

Pityriasis. Trifling redness of a limited portion of the skin, with furfuraceous desquamation of the cuticle covering the part, are the characters by which pityriasis is known. Pityriasis capitis is the most common variety. This is the disease known to the nurses by the names scurf and dandruff. The head itches, and directly it is rubbed, quantities of little scales, formed of epithelium, are detached. A similar affection occasionally occurs at the bends of the joints and over a limited extent of the trunk. When it has existed for some time in a severe form on the head, the hair often comes out in considerable quantity. It grows thin, but does not come off in patches, or to such an extent as to cause baldness.

Pityriasis rubra is the name applied to the disease when the redness is more decided, and there is roughness, rather than detached scales, on the surface. It occurs in patches. The most common exciting causes of P. rubra are exposure to the rays of the sun or to a cold dry wind; and frequent wetting of a part of the skin and then drying of it by evaporation. Children often produce pityriasis rubra of the lips by wetting the surface of the skin around the mouth with the tongue. No doubt many of the cases called pityriasis rubra are really examples of the driest forms of eczema.

Treatment. A solution of borax as a detergent, mild astringent ointments, and the avoidance of hard friction, as by the use of a hard hair-brush, are usually all that are needed in the treatment of pityriasis capitis. If these means fail, or if the disease be very troublesome, the following liniment will be found a valuable aid: R hydrarg. ammon. chlorid. ʒj.; ol. olivæ ʒj. M. To be applied to the head with a camel-hair pencil. When the hair falls out, a local stimulant often stays the mischief. Equal parts of acetum cantharidis and spirits of rosemary form a good liniment.

In pityriasis rubra, zinc ointment and the avoidance of exposure to the exciting cause generally effect a cure.

Aperients are frequently required. In severe, extensive, and obstinate cases of pityriasis rubra, vapour and sulphur baths are often useful.

Psoriasis. The disease now commonly known by the name of psoriasis was formerly, and is still by some, divided into two genera, viz. psoriasis and lepra. This distinction is based on no real difference between the two affections.

Psoriasis is a chronic disease characterised by slightly-raised red patches covered by white shining opaque scales.

The varieties of psoriasis are founded on the shape, size, number, or situation of the patches. Thus, when the spots are circular, small, numerous, and irregularly scattered over the skin, the disease is P. guttata; when they are long and broad, it is P. diffusa; when they are ring-shaped, the centre assuming a healthy appearance while the disease is spreading at the circumference, it is P. vulgaris or P. circinnata. It was to patches of psoriasis of this shape that the name lepra vulgaris was applied. When the patches are in the form of twisted bands, a very rare variety, it is called P. gyrata.

As to the varieties named merely from the part affected, there are P. corporalis, scrotalis, labialis, palpebrarum, palmaris, dorsalis, &c.

Psoriasis in all its forms runs a very chronic course, lasting not infrequently for many years. When cured, it is prone to recur. Some persons have an attack of psoriasis every year, some two in a year. Spring and autumn are said to be the seasons when these attacks occur.

The spots of *P. guttata* are from a quarter to half an inch in diameter, their centres are raised, and as they fade their centres heal first. *P. guttata* occurs on the trunk and extremities. The spots are often irregularly scattered over the whole surface. It is common for a few spots to be present in other varieties of psoriasis. The twisted bands of *P. gyrata* are said to be formed by the close approximation of separate spots of *P. guttata*.

P. diffusa begins in rather broad irregularly-shaped angular patches, which subsequently coalesce. Its most common seat is the extremities. The front of the leg, from the patella to the ankle, is occasionally covered with an unbroken patch of *P. diffusa*. The outer aspect of the forearm, from the elbow to the wrist, is also now and then the seat of a similar large patch. When *P. diffusa* is very severe and long continued, it has been called *P. inveterata*.

When the ring-shaped patches of *P. vulgaris* attain a very large size, the scales are sometimes wanting over a considerable extent of the ring. Under such circumstances there is a large red elevated ring, with patches of scales here and there. Within this ring are occasionally rings of *P. vulgaris* entirely covered with scales. The local accumulation of scales in psoriasis of the scalp is often enormous. When psoriasis affects the backs of the joints of the fingers, most painful cracks form; the scales in this situation are few. The itching is very troublesome in some forms of psoriasis, attaining its maximum when the disease affects the scrotum or the labia pudendi.

The red patches of psoriasis are due to inflammation of the cutis; the scales to excessive formation of epithelium on the inflamed surface.

Inflammation of the skin, attended by the effusion of the ordinary products of inflammation, leaves behind, supposing the patient to be disposed to the disease, a state of the part favourable to the formation of a patch of psoriasis. Thus a lad was in University College Hospital suffering from psoriasis. The disease had almost disappeared, when herpes zoster occurred, ran its ordinary course, and healed; but no sooner had the scabs separated, and that stage been reached in which only a faint red stain indicates the seat of the herpetic patches, than each reddish spot covered itself with scales,—in fact, was converted into a patch of psoriasis. A blister was subsequently applied to the lad's thorax. When it had healed, and the stage of simple redness was reached, the part on which it had been placed covered itself with scales. It may be, of course, that the herpetic inflammation and the inflammation excited by the blister acted especially by stimulating the vessels or the nerves or the formative power of the part. Probably all were affected; the formative power being disproportionately affected from the general state of the health. As bearing on this question, it is interesting to note that, in *P. guttata*, if the points at which the spots are originating be carefully sought out and examined, the redness and the scales will be seen to be forming at the orifice of the hair-follicles, not in all instances, but in the majority.

Psoriasis occupies the drier and coarser parts of the skin. Hence it is most common on the knee, just under the patella; and at the elbow, on the skin covering the olecranon process of the ulna. In regard of situation, it occupies the parts which differ most in texture from those occupied by eczema. When the patches are very numerous or very large, and spread from the back to the front of the arm, or from the front of the knee to the ham, the disease is worse or more extensive in the coarser-textured parts. Thus parts at which the sweat-glands are the most abundant are the chosen seats of eczema, while the same parts are rarely the seat of psoriasis.

Psoriasis is often connected with deranged stomach, and especially with a very subacute gastritis.

It is never communicated from one person to another. A tendency to psoriasis is undoubtedly hereditary. Psoriasis is a common syphilide. Whenever it affects the soles of the feet or the palms of the hands, the probability of its origin in constitutional syphilis should be investigated.

Care must be taken not to confound eczema of the palms of the hands with psoriasis of the same part. There is occasionally a difficulty in separating the two. In fact, eczema of this part is occasionally figured as psoriasis;

the thickness of the cuticle prevents its being raised into vesicles, the fluid formed is small in quantity and escapes notice; the consequence is that the chief feature of the case is the peeling of the skin of the palm. The most frequent exciting cause of the eczema, viz. carbonate of soda, used by women in washing, &c., so changes the cuticle as to aid in the production of a similarity between the two affections. Excluding, then, the syphilides, psoriasis of the palm of the hand is a much rarer disease than is generally supposed, and non-syphilitic psoriasis of the soles of the feet is very rarely, if ever, seen.

The drier forms of eczema of the neck, extremities, and trunk are occasionally mistaken for psoriasis. The different situation occupied by the two diseases suffices at once to prevent the error, by suggesting a doubt as to the case being what it at first sight resembles. A careful examination of the part shows the apparent scales of eczema to be formed of dried vesicles.

Treatment. Attention should in all cases of psoriasis be paid to the state of the stomach, in order that any thing approaching to subacute gastritis may not escape observation. Should it be indicated, then the diet must be carefully regulated, and this internal affection made the first object of treatment. In cases where there is no evidence of an inflammatory state of the mucous membrane of the stomach, the treatment is determined by the state of the local disease, and by the general condition of the patient; if the patches be hot and bright red, an antiphlogistic regimen and venesection, or aperients, or both, according to the age, the pulse, and the strength of the patient, are to be first employed. Should there be no unusual heat of the part from the first, or after the active symptoms have been subdued by the remedies above mentioned, liquor potassæ, iodide of potassium, tincture of cantharides, and especially arsenic in the form of Fowler's solution, are the most potent internal specifics. Liquor potassæ and iodide of potassium require to be given in full doses in a large quantity of some bland fluid.

Tincture of cantharides, an old remedy, was employed by Biett, who thought very highly of it, and by it alone cured a large number of obstinate cases. The dose to commence with is five minims twice a-day; it may be gradually increased till thirty or forty minims are taken, in divided doses, during the day. Its action must be carefully watched. Nausea, colic, diarrhoea, and troublesome erections of the penis are said by Cazenave to be the occasional consequences of its employment.

Arsenic, however, is undoubtedly the most potent of the remedies used in the treatment of all varieties of psoriasis. The dose of Fowler's solution is three minims three times a-day, gradually increased till eighteen or twenty minims are taken, in divided doses, during the day. Each dose should be taken on a full stomach, *i. e.* directly after meals. Its effects must be attentively watched. When any signs of its disagreeing occur, it should be omitted for a few days, and then resumed in smaller doses. The evidences of too strong action are inflammation of the tarsi, ophthalmia, nausea, colic, diarrhoea, and a troublesome dry paroxysmal cough. Other internal remedies which have been said to be occasionally of service are the decoctions of dulcamara and of mezereon, bichloride of mercury, calomel, and pitch. The decoction of dulcamara may be used with advantage as a vehicle for the more potent tincture of cantharides and liquor potassæ arsenitis.

Local remedies suffice in many cases for a cure; though in all local are greatly assisted by internal remedies.

The most potent external application is unguentum picis. The addition of a little creosote increases its efficacy. Nitrate-of-mercury ointment may be used when the patches are of small extent. Tepid, vapour, and sulphur baths are all occasionally of service.

TUBERCULA.

Acne is characterised by the accumulation of their secretion in the interior of the sebaceous follicles, with a tendency to inflammation of the follicle and of the tissue immediately around.

It is extremely common to find scattered over the face, neck, and shoul-

ders of young persons from the age of puberty upwards a very considerable number of black points, each placed on a slightly elevated pale base. These black points are called comedones. By pressure of the base, a little elongated white mass is expelled, vulgarly known as a worm, to which it has from its form, and the black point at its extremity, some resemblance. Interspersed are usually some black points resembling those just described, in all particulars excepting that their base is more elevated and inflamed. The inflammation generally terminates in suppuration, and then a small imperfect pustule is formed on the summit of a disproportionately large red base. The tissue around the follicle is involved in the inflammation, and not infrequently into this tissue, as well as into the walls of the follicle itself, sufficient lymph is exuded to give to the spot a singular degree of hardness. Where the hardness is the greatest, there is frequently no pustulation. If a pustule form, it dries up after a time into a small brown scab. After the separation of the scab and the disappearance of the hardness a very white smooth scar remains. The inflammation is usually very slow in its progress, and unattended with pain, especially when the induration is considerable; so that the shoulders may be found thickly set with acne when the subject of the affection is ignorant of its existence. When the pustule is the most striking feature, the variety is called *acne simplex* or *acne vulgaris*. When the black point remains on the pustule and comedones abound, it is *acne punctata*; and when the induration of the base is decided, *acne indurata*.

Acne is, without doubt, a disease of the sebaceous follicle. The starting-point of the affection is the retention of the sebaceous secretion. And in the so-called comedo this is all the disease, unless, which has not, however, been proved, the sebaceous matter itself be abnormal. To this retention of the secretion are due the elevation and the dilatation of the orifice of the follicle. The black point is merely the sebaceous matter at the orifice of the follicle, discoloured by foreign matter from without. In the sebaceous matter an entozoon known as the *acarus folliculorum* is frequently found.* This entozoon is not the cause of the disease, nor has it any influence on its symptoms or course. It is not even invariably present. In all these particulars it offers a striking contrast to the vegetable parasites in the genus *tinea*, and to the *acarus* in scabies, which are, beyond cavil, the determining causes at least of the visible phenomena of the diseases in which they occur.

The sebaceous matter, either by its quantity, by its quality, or by the two conjoined, induces inflammation of the follicle and adjacent tissues. Whether the pus or the induration-matter predominate depends partly on situation, but partly on unknown circumstances; thus *acne vulgaris* is more common on the face, *acne indurata* on the shoulders.

Acne is almost confined to the parts above the level of the *mammæ*; and when so low as that, it is all but always present on the face. The extremities, with the rare exception of the back of the arms, are exempt from acne. Children never, aged persons very rarely, suffer from *acne punctata*, *acne vulgaris*, or *acne indurata*. Early youth is the time most favourable to the origin of the two first; adult age to the origin of the last. Errors in diet, leading to derangement of the abdominal organs, the menstrual erethism, and masturbation are said to be causes of these forms of acne.

Acne rosacea is the name for a much more grave variety of acne, characterised by small pustules on a red elevated base, more or less closely placed on a limited extent of surface. The skin between the pustules is itself the seat of erythematous inflammation, and several small veins filled with blood are often seen to course around and between the pustules. Occasionally no distinct pustules are present, only the skin is red, inflamed, and has an uneven yet shining, greasy aspect. Seen with a lens, the unevenness of the erythematous surface is found to be due to minute losses of substance at the orifices of some of the sebaceous follicles; while the orifices of others are dilated,

* This parasite was discovered in 1842 by Dr. G. Simon; see *Die Hautkrankheiten*, Berlin, 1851, p. 312. Professor Owen calls it *demodex folliculorum*.

and the secretion retained. Minute crusts are sometimes seen at the bottom of the little pits. The pustules are commonly more developed in men; the erythematous redness in women.

Acne rosacea is a very chronic disease. At first it may from time to time almost disappear; but it returns again and again at short intervals, each attack leaving the skin of the part redder, thicker, and more uneven. Very considerable hypertrophy and induration of the follicles and tissues in which they are placed is an occasional result of repeated attacks. This terrible consequence of acne rosacea is almost limited to men.

This variety of acne is a disease of advanced adult age; it is common at all ages after thirty. In women it often commences just before the cessation of the catamenia. Its seat is the face, and especially the extremity of the nose; it is here that the hypertrophy and induration of the follicles ensues. Beginning at the nose, it commonly spreads to the cheeks.

Indulgence in the luxuries of the table, intemperance in the use of alcoholic fluids, excessive study, and profound grief, are all considered to be causes of acne rosacea; although certainly it often occurs without the action of any of these causes. The disease is not uncommon in water-drinkers. Derangements of the stomach, liver, and bowels are the most common concomitants. The subjects of acne rosacea often suffer from hæmorrhoids.

Under the name of acne sebacea of the scalp, Cazenave has described a disease which manifests itself at first solely by hypersecretion of sebaceous matter. This matter, drying on the surface of the scalp, forms thin layers, and ultimately constitutes a "mechanical impediment, which determines the fall of the hair, and may produce true alopecia." On the face the sebaceous matter drying into scales, coloured by foreign matters, has produced an appearance which has caused the disease to be mistaken for ichthyosis. In very rare cases of acne sebacea of the scalp, Cazenave has seen the sebaceous matter continue fluid after its escape from the follicles, and being tenacious, cause the hairs to adhere to each other, as in *plica polonica*.

Ecthyma is the only disease for which acne can be mistaken; but the relation of the pustules to the sebaceous follicles, as well as their limited distribution, render the diagnosis easy even to the most inexperienced.

Treatment. So long as no inflammation is present, the best means for favouring the exit of the contents of the sebaceous follicles are the rubbing in of oleaginous matters—*e. g.* cold cream or washed lard—to the face every night; and the free application of strong soap and water in the morning, followed by friction with a soft towel. If these means prove insufficient, the following motion may be used in addition three times a-day: $\mathcal{R}$ hydrarg. bichlorid. gr. xij.; $\mathcal{O}$ p. vin. rect. $\mathfrak{z}$ j.; mist. amygdal. amar. $\mathfrak{z}$ vij. $\mathcal{M}$. sit lotio.

During the stage of acute inflammation, and so long as the pustules are very tender, tepid water, or tepid water containing a little gelatine in solution, is the best application. Subsequently, and in the cases that are more indolent from the first, the unguentum sulph. hypochloritis is as efficacious as Mr. Wilson states it to be. Other ointments, from which occasionally much benefit is derived, are the following: $\mathcal{R}$ hydrarg. ammon. chlorid. $\mathfrak{O}$ j.; unguent. cetacei $\mathfrak{z}$ j. $\mathcal{M}$. ft. ung. $\mathcal{R}$ sulph. biniodid. 3ss.; unguent. cetacei $\mathfrak{z}$ j. $\mathcal{M}$. ft. ung. A warm-water douche 100° to 104° F. directed on to the part for ten minutes, is said to be of service. Biett recommends the cold sulphurous douche. Where other means have failed, Cazenave says flying blisters have promoted the absorption of the lymph in acne indurata, and so modified the action of the surface that no fresh tubercles have appeared.

While local means are never to be neglected, attention should at the same time be given to the state of the digestive organs. The bowels must be kept freely open. The secretions of the liver, if at all deficient, should be excited by mercurials; for this purpose, one of the best means is the pil. hydrarg. chlorid. co. in doses of five grains at bedtime, once or twice a-week. A saline aperient, with sulphur, may with advantage be given after the mercurial. $\mathcal{R}$ magnes. sulph. $\mathfrak{z}$ j.; magnes. carb. $\mathfrak{O}$ j.; sulph. præcip. 3ss.; syrapi $\mathfrak{z}$ j.; aq. 3x. $\mathcal{M}$.

ft. hst. primo mane sumend. Antacids, especially carbonate of soda and liq. potassæ, in full doses two or three times a-day, are often of great service.

Acne rosacea is frequently accompanied by derangement of the uterine functions or of the digestive organs. Those who suffer from it are generally deficient in tone of system. A generous diet, with a moderate supply of wine, is, as a rule, essential for a cure. Tonics, with antacids, as, for example, decoct. cinch. 3x.; tinct. cinch. co. 5ij.; potas. bicarb. ʒj.; ammon. sesquicarb. gr. iv. M. twice a-day, are frequently of service. When the liver, as is often the case, is congested, occasional doses of blue-pill, followed by saline aperients, are indicated. The local treatment should be that described for the other forms.

Molluscum is characterised by round elevations, varying in size from a hemp-seed to a large currant or a hazel-nut, with a dark point and a depression on the summit of each. They have rather a translucent appearance; the colour of the skin over them is either normal or pinkish; occasionally there is a slight lobulation in them, visible through the skin. Some of the growths have no central depression and no black point. Some have a broad base (*M. sessile*), whilst others have a peduncle (*M. pendulum*). The skin over them is usually tense; it is occasionally wrinkled. These tumours either increase slowly in size, without any other change, or they ulcerate on the surface and their contents escape, or they inflame and slough *en masse*. They have been commonly believed to be sebaceous glands hypertrophied and altered. Some of them contain a white waxy or semi-fluid material, and a cyst which in some cases consists of several sacculi opening into a common cavity. Under the microscope are seen oil-globules and epidermal cells filled with granular matter. Others are more fibrous in structure. Dr. Beale² considers molluscum due to an alteration of the structures concerned in the formation of the hair, especially of the cells at the bottom of the follicle and the follicle itself, with hypertrophy of the subcutaneous areolar tissue.

Dr. G. Simon[†] describes two forms of the disease; one, which he calls molluscum simplex, he describes as due to an extra formation of connective tissue without any change in the hair-follicles or sebaceous glands; and the other, which he calls *M. contagiosum*, he regards as due to hypertrophy of the sebaceous glands.

It seems probable that there are two distinct diseases (both called molluscum), which present very similar naked-eye appearances, but are anatomically quite different.

Bateman, Cazenave, and others, used the term molluscum contagiosum; but most recent observers do not believe in the contagious character, and drop the epithet "*contagiosum*." M. Hardy states that he had not believed in the contagiousness of the disease till within the last few years, during which he has seen instances of what seemed to be evidence that it could be thus propagated. He thinks that this property is to be explained by the presence of branched tubes containing the spores of a cryptogamic plant, which he believes are constantly to be found in the tumours of molluscum. Professor Hebra, on the other hand, has tried to propagate the disease by rubbing the contents of the tumours on different parts of the skin without any result. The usual seats of molluscum are the trunk (either back or front), the neck, face, and scrotum. It is not attended with any constitutional disturbance. It may exist at any age, but is most commonly met with in children.

Treatment. This is purely local. The tumours may be laid open, and the interior rubbed with lunar caustic. If attached by a pedicle, they should be snipped off and the base cauterised.

T. H.

Lupus,[‡] as defined by Willan, was a tubercular disease commonly attended

* *Path. Soc. Trans.* vol. vi. p. 313.

† *Die Hautkrankheiten*, &c., Berlin, 1851, pp. 235, 354.

‡ The reader is referred for the study of this disease to the valuable plates illustrating lupus in its different forms and stages, published in the *Atlas der Hautkrankheiten* of Professor Hebra.

with ulceration ; Cazenave included under the same name a disease not leading to ulceration and without tubercles (lupus erythematosus). Both forms of the disease involve the derma, cause interstitial absorption and atrophy of that tissue, and are both followed by a scar. They are distinguished also by running a chronic course, and are specially prone to attack the skin of the face.

The varieties of lupus are classified as follows :

1. Lupus exedens.

2. Lupus non-exedens. *a.* tubercular ; *b.* erythematous, or non-tubercular.

1. The beginning of the disease is marked by brownish red, tolerably firm eminences of the skin (tubercles) of varying size, the average being that of a millet-seed. When small, they are papules rather than tubercles. Occasionally the disease begins on the nasal mucous membrane. The elevations of the skin are soon covered with a smooth transparent cuticle, or a white scale ; they enlarge in diameter and in height, and become merged into adjoining tubercles. They thus attain the size of beans, or assume the form of raised flattened patches of some extent. More rarely the tubercles attain the size of large nuts (lupus hypertrophicus) ; these larger growths occasionally assume a more or less œdematous appearance, and become softened. The tubercles frequently continue many months without change ; in other cases they advance in size, and new papules or tubercles spring up. The new growths are commonly fused into the parts previously affected. On the other hand, after an uncertain period, the parts first attacked, instead of advancing, undergo retrograde metamorphosis in one of two ways. (1) The tubercles, or patches, become flattened with or without an extra formation of epidermic scales on the surface.* (2) The morbid structures ulcerate. The ulceration commences in the middle of each patch, and small crusts, at first isolated but soon running into each other, are formed. In this way a large surface is covered with dark crusts that speedily dry and crumble ; the crusts are very adherent, and consist of pus, blood, and sebaceous matter ; instead of being rough and dark-coloured, they are sometimes smooth and yellow. In some cases they are undermined with fluid instead of being firmly adherent. On the removal of the crusts, there are seen either granulations, simple excoriations, or deep ulcerations. The granulations vary in size from that of small pins' heads to that of nuts ; their colour is brownish red. The excoriations vary in diameter from one-sixth of an inch to several inches, having an oval or angular outline. When there is ulceration, the ulcers are concave with grayish red or yellow exudation, having margins either everted or slightly undermined. Ulceration often destroys not only the skin, but also the ligaments and cartilages ; in this way the nose and the eyelids disappear, and the most hideous deformities result. The lower lid may be destroyed so that the skin of the cheek is continuous with the ocular conjunctiva ; the eye becomes the seat of chronic inflammation, the conjunctiva is thickened, the cornea becomes opaque, and blindness ensues. When the eyelid is not entirely destroyed, small ulcers are often formed, and by their cicatrization eversion of the lid is caused. Erysipelas not very unfrequently complicates lupus, especially under the influence of stimulant or caustic applications, and often tends to arrest the progress of the disease. Under other circumstances the process of destruction after an uncertain period stops short ; exudation on the ulcerated surface becomes more scanty and more consistent ; cicatrization begins at the circumference and extends towards the centre, until the surface is covered with a thin glistening layer of epidermis, which allows the red corium to be seen beneath it. By degrees the spot becomes paler, and a cicatrix is left either smooth, or beset with elevations radiating from one point, or with œdematous-looking trabeculæ. These scars after several years lose the red colour, become white, and cause deformities varying according to their situation. In one case there is eversion of the lower eyelids, in another eversion of the lips, and in another drawing down of the point of the nose. In other

* This process constitutes the true lupus non-exedens.

instances contraction of the skin of the neck takes place so as to prevent free movement of the head, or false ankylosis of the joints is induced. Whilst cicatrisation is going on at one part, fresh papules and tubercles are developed at another. When the disease spreads in circles or segments of circles, it is called serpiginous.

The progress of this malady is, as a rule, attended with very little pain, but with occasional itching. In the most severe cases of lupus exedens, when it extends its ravages very deeply, the patients are liable to chronic gastro-enteritis, and often die in a state of low fever with colliquative diarrhoea. The course of the disease is very chronic, lasting ten, twenty, or thirty years or more. In some cases its course of destruction is very rapid. The usual termination is in cicatrisation; there is a great tendency to relapse and renewal from time to time. Biett anticipated a relapse when the cicatrices remained soft, bluish, and surrounded by soft tumours, or if, after cicatrisation, the tumours did not disappear. The favourite seat of lupus is the face, especially the nose; but no part of the skin is exempt from its ravages. Anatomically, lupus appears to consist of a new formation of connective tissue in the corium, accompanied with some injection of vessels and a transparent blastema. By the extension of this tissue, atrophy of the hair-follicles, sebaceous glands, and papillæ results. According to Wedl, this connective tissue may extend into the adipose and muscular tissues, and even into the bones. The pus which subsequently appears is, he says, a new formation from the blastema, and not produced by disintegration of the newly-formed connective tissue, or of the healthy structures.

Causes. Very little is known on this point. The disease is regarded by most authors as due to a peculiar diathesis, by some considered identical with scrofula, and by others to be syphilis modified by transmission through several generations. Many persons attacked by it are in apparently perfect health; but many are of a phlegmatic temperament, with flabby muscles and languid circulation. It is slightly more frequent in women than in men, and more common in youths and young adults than in persons above the age of forty.

Treatment. General. The combination of iodine, arsenic, and mercury, known as Donovan's solution, is frequently of great service. Cod-liver oil combined with it or given alone in free doses is very useful. Occasional doses of calomel and opium instead of the mixture above named will be sometimes of greater benefit. The iodide of iron with cod-liver oil will be useful in cases of anæmia.

Local. A powder containing calomel mixed with from $\frac{1}{2}$ to 5 per cent of arsenic is a useful application when the disease is spreading. Some prefer more powerful caustics, such as chloride of zinc mixed with an equal quantity of flour, the strong nitric acid, or the acid nitrate of mercury. They are indicated when destruction is proceeding rapidly.

2. Lupus non-exedens. *a. Tubercular.* This form is more nearly allied to lupus exedens than the erythematous form of disease. It begins in the same way, but does not run on to ulceration. The tubercles on the skin become covered with thin scales, not with thick crusts; and the tendency is rather to the formation of fresh tubercles around the margins than to extension in depth. After lasting some time the tubercles are flattened, become pale, smooth, and a scar remains.

b. Erythematous. This superficial variety of lupus begins as red, sharply defined, small, elevated spots, slightly rough on the surface. Frequently there are seen on these spots the orifices of sebaceous follicles plugged with dried contents, which after a time run into each other; or they are covered with small white thin pellicles, from the under surface of which, when detached, are found filaments which come out of these follicles. The surface remains bright red, or covered with white or darkish-green scales, whilst the circumference is extended by growth at the margins. At times the centre is healing while the margin is advancing. The parts that are healing become freed from scales; the redness decreases, until at length it quite disappears, and a pale, smooth, indistinct scar is left, or the skin almost resumes its healthy look.

This variety is almost confined to the face, and is more common in females than in males.

The treatment for lupus non-exedens is the same as for lupus exedens, except that strong caustics are not required. When only one or two tubercles are present, the free application of nitrate of silver will often arrest the disease. An ointment containing 10 grains of iodide of mercury to an ounce of lard, or a scruple of iodide of sulphur with the same quantity of lard, is a suitable application.

For the erythematous form of the disease a mixture of equal parts of carbolic acid and glycerine is a good remedy, or tincture of iodine. The two forms of tubercular lupus may be met with in the same person, and run into each other. There is some doubt, however, whether the erythematous lupus does ever run into the tubercular lupus, or is a totally distinct disease.

Diagnosis. Some forms of acne may simulate lupus at an early stage. Lupus, however, is never limited to the sebaceous follicles, and it gives rise to a characteristic cicatrix. The diagnosis from tubercular syphilide is often more difficult. In the latter disease, however, the tubercles are usually harder, rounder, and have a more coppery tint, with less tendency to desquamation than in lupus. If ulceration occurs, the ulcers in syphilis have sharply-cut well-defined borders and grayish floors; whilst the ulcers of lupus have a darker tint, and are everted or undermined at their edges. The syphilitic tubercles most frequently spread in segments of circles, and are more rapid in their growth than the tubercles of true lupus.

Cancer of the skin usually occurs at a more advanced age, and is attended by induration and acute pain. Before ulceration, it presents no resemblance to lupus; after ulceration, the cancer is distinguished by the absence of crusts, by the form of its borders, and the presence of an inflammatory areola. It often attacks bone, which lupus usually avoids. A form of disease described by Bielt as "*Noli me tangere*" presents some affinity to lupus, between which and cancer it seems to form a bond of connexion. A single small ulcer appears on the side of the nose or cheek, round, and covered with a darkish crust. It is preceded by a slight swelling, and is never surrounded by tubercles. T. H.

Elephantiasis of the Greeks (the Eastern leprosy, *spedálskhed* of Norway) is a disease now scarcely ever met with in Great Britain, though it still prevails in India, Africa, Greece, Spain, Norway, and Iceland. It has been divided into two varieties,—the one characterised mainly by an albuminous exudation into and under the skin and mucous membranes; the other characterised by exudation into the nervous centres and nerves, producing anæsthesia. Both varieties are sometimes ushered in by lassitude, drowsiness, slight shivering, oppression at the epigastrium, and nausea. These prodromata last for a period varying from several weeks to many months. In the first form (which has been called *elephantiasis tuberculosa*), after the premonitory symptoms have lasted some time, an eruption appears, consisting of yellow, crimson, or deep-brown hard spots, slightly elevated, varying in size from that of a small pin's-head to that of the palm of the hand; the spots are round or irregular in form. According to most writers, the skin at these points partially loses its sensibility from the first. After a time the spots fade and disappear; subsequently they reappear on other parts of a deeper colour, and become more or less confluent. The eruption usually again slowly disappears, shortly to return; and this alternation occurs several times, until at length the spots become permanent. The parts on which they are most commonly first persistent is the face; afterwards the backs of the hands are attacked, and then the body generally. The smaller spots become thickened and changed into smooth shining tubercles, which remain isolated or run together. The tubercles increase in size, and are often separated by deep furrows; the epidermis is usually but little affected, but the true skin and subcutaneous areolar tissues are infiltrated; hairs on the affected parts become white and fall out. In addition to the tubercles, there are sometimes livid spots and patches on other parts. Darting pains are often felt in the

limbs, and the lymphatic glands are frequently swollen; the tubercles themselves are not painful, but sensibility is diminished in them. After an uncertain period the mucous membranes are involved; on the tongue and mouth spots and patches appear, which often bleed and grow into tubercles; the bronchi also suffer, and dyspnoea with foetid breath is induced. At length the exudation both on the skin and mucous membrane softens, and ulcerations covered by grayish brown crusts are produced. The eyes are subsequently attacked, and often destroyed; taste and hearing may also be lost. The severity of the constitutional symptoms is commonly in proportion to the extent of the local disease; except in the slightest cases there is prostration, with a small infrequent pulse and disturbed digestion. In the earlier period of acute cases there may be a quick full pulse and other signs of fever. The urine is said to be albuminous and deficient in urea. After the disease has lasted usually for many years, diarrhoea often hastens the fatal termination. It has been stated by some writers that the sexual passion is increased; but this, if correct, is probably true only of the earlier stages. The spirits are also said to be good, and contentment to be usual.* In a few instances the disease has been known to run an acute course.

Sometimes the tubercles disappear by absorption, and leave behind them cicatrices and furrows; at others they are removed by ulceration, and the scars then formed are hard, white, and irregular. In some tubercles, covered by a thick brown crust, acari in great abundance, and in all stages of development, are met with. Messrs. Daniellssen and Boeck are in doubt whether they are identical with the *acarus scabiei* or not.

The second form, *E. anæsthetica*, is more uncommon in central Europe than the other, though tolerably frequent in Norway. The mode of attack is generally more insidious. At the outset it is rarer to meet with febrile excitement, and there is more depression of spirits. The first local symptom is an appearance of large bullæ seated on livid patches: the bullæ break, and ulcers are left; crusts are formed on the ulcers, which subsequently heal. Fresh bullæ arise elsewhere, and run the same course. After a variable period a fresh order of very distinctive symptoms occurs: white patches appear irregularly over the body, accompanied by itching; the sensibility of those parts is diminished, and there is slight desquamation. These patches are not always met with; they constitute what has been described by the ancients as "*morphæa alba*,"—the "*white leprosy*" of many writers. Hyperæsthesia follows, and periodic shiverings; after a time anæsthesia sets in, and becomes extreme; it sometimes extends over the whole body. The parts affected are dry, whilst other parts may perspire abundantly. The conjunctivæ are injected, and vesicles are formed on them; the lids become atrophied, and the conjunctivæ dull, dry, and pale, and the lashes fall out. In rare cases, penetrating ulcers are formed on the cornea. The nasal mucous membrane becomes dry, ulcers form and destroy the septum.

Paralysis ensues in many of the muscles. A very singular symptom often occurs in the later stages: a spot—usually on the sole of the foot—becomes bluish; after some days fluctuation is felt, the skin sloughs, and a deep ulcer is formed, which seldom heals. Daniellssen states that if the ulcer heals rapidly, death ensues; and if the ulcer appears disposed to heal, the patient suffers much constitutional disturbance. In this variety the ulceration seems to commence in the subcutaneous tissue, not in the true skin. When anæsthesia is complete, the bones suffer; violent pains occur in them, livid swellings encircle a finger or a toe, ulcers are formed, and fingers and toes drop off. Sinuous ulcerations form, and carious bone is detached. Before death diarrhoea commonly occurs, and sometimes cramps of a tetanic character. During the course of the disease, there is great thirst, moderate appetite, a feeling of cold, occasionally vomiting and pyrosis, with torpor and drowsiness. There is sometimes anasarca, and in these cases the urine is albuminous. Both forms of the disease occur most frequently from the age of ten or twelve

* Dr. Webster, *Med. Chir. Trans.* vol. xliii. p. 27.

years to twenty or thirty ; but it may be met with at any period from infancy to old age ; both sexes are liable, but males more so than females. There has been doubt thrown on the question of the hereditary character of the disease, though this is generally believed in. It would appear to be contagious and inoculable, but not infectious. It is endemic in many localities, and is most common amongst those who are badly housed and fed. There has been a decided increase of the disease of late years on the western coast of Norway, and this increase is dependent in some way on the mode of living adopted by those engaged in the fisheries. It is very commonly more severe near the sea-coast than inland.*

Morbid anatomy. The exudation peculiar to this disease is viscous fibrino-albuminous fluid, with some fat and salts ; in the first variety it concretes into a semi-opaque mass ; in the second it retains its transparency : when effused into different organs, it tends to their disorganisation by the interruption of circulation, and by the process of softening. The exudation is met with in lymphatic glands, on mucous and serous membranes, in vessels and nerves, as well as in the liver, spleen, and kidneys. In the anæsthetic variety the exudation extends to the spinal cord, almost covering it, especially posteriorly ; the arachnoid and pia mater become glued together, and the substance of the cord gets injected and very hard. The exudation sometimes extends to the roots of the nerves within the vertebral canal ; and the same changes are often met with to a less degree in the cerebral pia mater and arachnoid.

Treatment. Mercury, arsenic, and iodine have been used in former times, but are now discarded. Some authors maintain that the iodide and bromide of potassium are of service. Tonics, good diet, the frequent use of baths, and a general attention to hygienic rules are said to be of most value.

Elephas pachydermia, Barbadoes leg, or the elephantiasis of the Arabs, must not be confounded with the disease just described. It is characterised by hypertrophy of the skin, and of the subcutaneous areolar tissue. It may affect the leg, the arm, the scrotum, or the mamma. The disease frequently begins with acute febrile symptoms, darting pains, and a feeling of tension in the course of the superficial lymphatics, which soon swell and form knotted cords, whilst the glands become swollen and tender. The superficial veins sometimes become hard and corded ; occasionally there is diffused redness of the skin. All these symptoms may disappear, and after a certain time recur. The part swells ; it is not painful, but merely uneasy from tension. The glands become large and hard, and the affected part slightly swollen. After several relapses, the swelling becomes much increased ; it is soft, and pits on pressure. At length the skin is white and shining, or it is of a dark colour, much thickened, and studded with projecting veins ; the swelling is now immense and quite hard. The lymphatic glands often suppurate or slough ; the joints are sometimes invaded by chronic inflammation ; and the skin may become covered with scales, as in ichthyosis ; or unhealthy, intractable ulcers may occur. Frequently, however, none of these complications ensue ; the general health remains good, and the only inconvenience experienced is from the size of the swelling. In the scrotum this disease may attain an enormous size, so that the tumour weighs from fifty to a hundred pounds. The cuticle is often thickened, at other times quite unchanged.

Morbid anatomy. The cutis is more or less hypertrophied. The skin is marked by deep furrows, which sometimes give the surface a nodulated look. Between the deep furrows the surface of the cutis is either smooth or covered with a multitude of protuberances. These are either small, looking like moderately enlarged papillæ ; or large, and may take the form of broad bunches or slender cones, many of which are cleft at their summits. They have been compared by Henle to syphilitic condylomata. The subcutaneous membrane is thickened usually by a substance which looks like condensed areolar tissue ; it may resemble fibrous tissue in appearance, and adhere firmly to the skin.

* *Brit. and For. Med.-Chir. Review*, April 1858.

Sometimes the intermuscular areolar issue is affected, and the muscles are atrophied, or become fatty. The bones are occasionally diseased, thickened, and nodulated. Sometimes an albumino-fibrinous fluid is found in the meshes of the newly-formed tissue. This disease is endemic in the tropics. It is most common in adults, and is somewhat more frequent in men than in women.

Treatment. Iodine, frictions, and regulated pressure are the means which have been found useful. When it attacks the scrotum, it may be dealt with as described above in the essay on DISEASES OF THE MALE ORGANS, p. 619. When the leg is attacked, amputation may also be had recourse to; but is only to be advised when the limb is of very great size. In elephantiasis of the leg the ligature of the femoral artery has been followed by the subsidence (to a great extent, at any rate) of the disease. This treatment, which was first recommended by Dr. Carnochan of New York,* has been followed with success by Mr. Butcher and others.†

T. H.

Frambæsia (yaws). This is an exanthem rarely, if ever, seen in England; it has, however, been met with in the north of Scotland and in Ireland; it is common in the West Indies and Africa. At the onset there is slight fever, which is soon followed by an eruption of small flat papules, which increase in size till they attain a diameter of half an inch; the crop of papules is not completed at once; new ones appear whilst old ones are declining. The eruption is greatest, and the spots are largest, on the face, axillæ, arms, groins, and pudenda. After eight or ten days the eruption becomes pustular, and a crust is formed, beneath which a foul sloughy ulcer is found. On the surface of this ulcer red fungous granulations spring up. These ulcers exist in all stages on the body at the same time, and are often accompanied with ulceration of the throat. The eruption may continue from a few weeks to seven or eight months; after a time the sores contract and cicatrise, leaving no mark unless the inflammation has run high. The disease is followed by much emaciation and debility; and frequently by dropsy. *Frambæsia* is transmitted by contagion; it has been communicated by inoculation. It is rare amongst the white races of mankind.

Treatment. Locally, mild stimulating ointments; internally, tonics, nutritious food, and occasional alteratives; aperients appear to be indicated. Mercurials have been used in former times, but are now generally believed to be worse than useless.

T. H.

KELIS, OR KELOID.

It appears to be uncertain whether the name of this somewhat rare disease was derived from *χηλή*, a crab's claw, or from *κηλίς*, a scar, such as is produced by a burn. It is probable that Alibert, in using the word, had the first-named derivation in his mind; he first described the disease under the name of *cancroïde*, that is, like *cancer*, or a *crab*.‡ Dr. Addison§ has adopted the latter derivation, and has described two forms of disease which he calls "the keloid of Alibert" and "true keloid." There is room to doubt whether these affections are distinct diseases, or mere varieties of one disease. The keloid of Alibert first appears in the form of small hard shining tubercles, roundish, oval, or quadrilateral, somewhat firmly set, of a dusky or deep-red colour, and generally attended with itching, pricking, shooting, or dragging pain in the part.

These tubercular elevations slowly increase in size until they attain a height of two or three lines, and comprise an area varying from that of a horse-bean to that of a small almond. The tubercles often become pale on their summits, and somewhat glistening; they are hard, firm, and elastic, like fibro-cartilage; after a while they become broader, more irregular, and

* *New York Journal of Med.* Sept. 1852; Gross, *Syst. of Surg.* vol. i.

Dublin Quarterly Journal, May 1863.

Description des Maladies de la Peau, 1806. § *Med.-Chir. Trans.* 1854.

occasionally depressed in the centre. Soon delicate, whitish, tendinous-looking lines, with minute blood-vessels, are observed on the surface of the swellings; each separate swelling extends by tapering claw-like processes, from a quarter of an inch to an inch in length, which appear to cause a puckering of the skin. Growth takes place very slowly for months, or even years, and a size may be attained of an inch or two inches in length by half an inch or an inch in breadth, and an elevation above the skin of three or four lines. Sometimes years elapse without any change in the affected parts. The swellings are solitary or multiple; in the latter case they are near together or far apart. The development of them is usually preceded or accompanied by heat and some degree of puffiness of surrounding parts; but there is no redness.

At an advanced period of the disease pressure often causes much pain.

The morbid growth is sometimes formed on the cicatrix of a burn or other wound, and especially on that of wounds caused by flogging; but it is frequently developed on sound skin. Alibert called the disease, when produced on an old scar, *spurious keloid*; Dieberg* has called it "Narben-keloid," the cicatrix keloid; and when not preceded by a scar, *spontaneous keloid*. The first variety appears to be rather more frequent in men, and the latter in women. Both forms occur commonly between the age of puberty and middle age; the favourite seat is the front of the chest, but it may attack any other part of the body. From its frequent occurrence in several parts at the same time, it has been believed to depend on some peculiar diathetic condition. Alibert states that *spontaneous keloid* is accompanied with much more pain than that kind which occurs on an old scar.

Dr. Addison has given the name of *true keloid*† to a form of the disease which, like the other, has its seat in the subcutaneous areolar tissue, but is first indicated, not by tubercular elevations, but by a white roundish patch of the skin, varying in diameter from the sixth of an inch to an inch and a half or two inches, very slightly elevated, and surrounded by a zone of redness, or some venous congestion. It is unattended at the beginning with pain or uneasiness; occasionally it presents here and there on its surface a faint yellowish or brownish tint. After a time there is itching and pain, with a feeling of tightness or constriction in the affected part, and frequently a certain amount of subcutaneous hardness and rigidity, extending beyond the site of the original patch, and not accompanied by any change in the aspect of the skin; at length the part first affected becomes more or less hide-bound, and a similar change takes place among the more superficial tendons and fascia, so that the tendons become so fixed that they can no longer perform their functions. In this way a whole member may be permanently contracted. The fingers are specially liable to this condition. After a time the skin shrinks or shrivels, assumes a dry, smooth, or glistening aspect, becomes reddish or yellowish, the cuticle exfoliates, and there is a tendency to superficial ulceration, or to the formation of obscure nodular elevations. From some part of the boundary of the shrivelled skin there are sometimes seen reddish elevated claw-like processes of from half an inch to two inches in length, extending into the sounder integument. During the progress of the disease it is not uncommon to find oval or roundish, and flattened, hard, tubercular elevations about the size of a split-pea or horse-bean, without any discoloration, except what may result from accidental friction.

Prognosis. Both these forms of disease are very chronic and intractable. They do not appear to exercise any decidedly injurious effect on the general health. Their gravity is due solely to the local inconveniences.

Treatment. Extirpation by the knife or by caustic has been constantly followed by their renewal. The use of iodine has been recommended; but there is no evidence of its having done any good. T. H.

* *Deutsche Klinik*, Aug. 1852.

† This use of the term *true keloid* appears to have caused some confusion, in consequence of Alibert's having previously appropriated it to the *spontaneous keloid* commencing exactly in the same way as that developed on a scar.

Gross, in his *System of Surgery*, describes, under the names 'eiloid' and 'lepid,' two diseases not mentioned by most other authors.

Eiloid is the name given to a tumour of the skin very rarely met with. It was so called by Dr. J. C. Warren, of Boston, from its peculiar coil-like disposition. It presents at first the appearance of a small elevation, somewhat like that caused by a burn; it goes on to increase without pain, heat, redness, or ulceration, until it attains a large size, and sensibly affects the general health. The case described by Dr. Warren was that of a Negress, aged fifteen, who had not been in good health. The disease assumed the shape of coils lying side by side, each about four inches long, and looking like a triple coil of inflated intestine. The tumour was removed with a portion of sound skin, but soon returned; it was again extirpated, but rapidly reappeared; and the patient shortly after became dropsical, and died. There was serious disease in the liver, ascites, and enlarged mesenteric glands. Of the anatomy of eiloid nothing is known; it is said to take its origin in the derma.

Lepoid is commonly seen on the face, nose, and forehead of elderly persons, usually males, of a delicate florid complexion, with tendency to congestion of the capillary vessels, and having light eyes and hair. It may be single or multiple. It generally makes its appearance as a small speck, about the size of a mustard-seed, and of a dirty-grayish colour, soon becoming covered with a rough brownish scale resembling the bark of a tree, from which it derives its name. The first scale or crust falls off, and is succeeded by another of the same nature. In this way the disease may be kept up for years. At length ulceration sets in, and a red glossy surface is presented, pitted or granular, secreting a thin pus. The skin is found to be very hard, its inner surface being studded with numerous little white roundish bodies connected together by a dense grayish material. The disease is attended with itching, but not with pain.

The nature of lepid is undetermined. Gross is inclined to believe that it is merely a variety of lupus or epithelioma.

It is recommended not to interfere with this growth. The rough bark-like scale may be softened by citrine ointment much diluted, or covered with a mixture of two parts of collodion and one of castor-oil. T. H.

MACULÆ, OR PIGMENTARY CHANGES.

These changes are seated in the deeper layers of the epidermis, the so-called rete mucosum. They may be classed under two heads: 1. those in which there is excess of pigment; 2. those in which there is a deficiency of pigment.

(1) *Excess of pigment.* Different races of man exhibit very different amounts of pigment in their skin; the natives of hot climates have much, and those of cold climates little pigment. Developmental changes in the organs of reproduction are often attended with an increased production of pigment; and at the age of puberty there is commonly a darkening of the skin of the sexual apparatus. During pregnancy the areola around the nipple becomes of a darker colour; rare cases have been described, in which this discoloration has extended at this period much further, even over the whole front of the body. During menstruation the lower eyelids are often discoloured, sometimes from a sort of venous lividity, in others from real pigmentary deposit. Heat and light have the effect of increasing cutaneous pigment, either uniformly or in spots, called freckles (*ephelis*). Yellowish brown, round or irregular, spots or patches are thus produced on exposed parts, especially in persons of fair complexion. When spots of this kind are more permanent than usual, they are called *lentigo*, or *ephelis lentigo*. The skin on the front of the legs of old people often becomes of a brown or liver colour; this change is said to depend on exposure to artificial heat. Many skin-diseases leave the skin with an excess of pigment, especially psoriasis, eczema, and prurigo.

Cases are on record in which mental emotions have suddenly induced an

excessive formation of pigment ; it is more common, however, to see from this cause, in the hair, which is homologous with the epidermis, a loss of pigment. The whole hairy scalp has been said to have become gray in a few hours from intense anxiety or grief.

Dr. Addison first called attention to a peculiar discoloration of the skin (a bronzing), which he connected with disease of the supra-renal capsules ; it is accompanied by progressive debility, anæmia, occasional giddiness, and gastric disturbance, and terminates fatally at the end of a few years. The colour of these patients is brownish, with sometimes an olive-green tint, and it very closely resembles that seen in the darker races of man. The depth of tint varies in different cases, being most marked in the parts most exposed, and also those in which there is normally an excess of pigment ; as, for instance, around the axillæ and near the umbilicus. The pathological connexion between the cutaneous change and the supra-renal disease is not very obvious ; it has been supposed by some that they are both dependent on irritation of the solar plexus of nerves. It appears, at any rate, to be satisfactorily proved that a bronzing of the skin, accompanied by certain constitutional symptoms, not traceable to any other cause, may be safely assumed as pathognomonic of a peculiar morbid change in the supra-renal capsules. The capsule is first changed into a translucent softish homogeneous substance, which after a time is converted into an opaque yellowish material, and at a later period into a putty-like matter or a dry chalky mass.* (Other changes occur in the supra-renal capsules without pigmentary change of the skin ; and on the other hand the skin may undergo discolorations very similar to, if not identical with, those accompanying Addison's disease, without the peculiar constitutional symptoms or disease of the capsules. A case of this kind is described by Dr. Parkes, in which the skin of a man aged 55 years, five months after an attack of jaundice, became gradually dark on the body, arms, and thighs, until the hue was that of the skin of a mulatto ; over the abdomen, thighs, and scrotum there were white patches interspersed ; below the knees the skin was of its natural colour. In this case the supra-renal capsules were found quite healthy ; the liver was contracted, and had given rise to ascites. Similar cases are also on record in the *Pathological Society's Transactions* (as e.g. vol. xii. p. 262) ; other instances have been met with, in which the skin was mottled with dark and white patches ; two such cases are mentioned by Dr. Addison, and considered by him to belong to the same category of supra-renal disease. In one of Dr. Addison's cases the capsules were diseased ; in the other no post-mortem examination was made. Dr. Wilks doubts whether this peculiar mottling, a combination of bronzing with pallor, or *leucopathia*, is in any way connected with supra-renal disease.

Moles (nævi lenticulares, or liver-stains) are congenital spots or patches on which there is an excess of pigment.

They are sometimes round, sometimes of irregular shape ; and they have either a brown, yellowish-brown, gray, or blackish colour ; occasionally they are covered with hairs, which are thicker, stiffer, and darker, than the hair of the adjoining skin.

In size they vary from a pin's head to a diameter of several inches. They are either quite flat, or raised above the level of the surrounding skin. There may be one or many of them on one person.

They are formed by an excess of pigment in the deeper layers of the cuticle ; which is often thicker than it is on other parts of the surface : and in those moles which project above the level of the skin there is a thickening also of the derma.

They are occasionally the seat of troublesome ulceration, from friction or other cause. In such cases it may become advisable to excise them.

(2) *Want of pigment*. This may be congenital and universal, involving

* Dr. Wilks, in *Guy's Hospital Reports*, vol. viii.

not only the skin, but the hair, the iris, and the choroid, constituting *albinism*. Several albinos have been met with in the same family, or one member only of a family is affected. Albinism has been observed to be transmitted by inheritance to one sex more than to the other; in one family preferring males, and in another females. This affection occurs occasionally in all races of mankind, but is more common in hot than in cold climates. There is intolerance of light, and usually a want of power both in body and mind.

Partial loss of pigment is also more common amongst the darker races, at any rate it has been more noticed amongst them. Negroes congenitally "piebald" are by no means very uncommon.*

Vitiligo is a term differently used by different writers. It is now commonly employed to designate patches characterised by loss of pigment. In some cases there is a slight depression of surface in these white patches, with branny desquamation.

Silver stain. The internal use of the salts of silver for a long time produces a peculiar livid or slate-coloured tint of skin. No remedy is known for this condition.

Besides the changes of colour above described, there are some rare cases on record in which a free excretion of pigment has taken place on the eyelids; in some cases black, in some yellow, and in others blue. The fluid in which the pigment appears is somewhat unctuous, and the affection has hence been called *steorrhœa nigricans*, *flavescens*, and *cærulea*.† The secretion may be wiped off; but appears again at the end of a few hours. The subjects of these cases have generally been women who have suffered from uterine derangement; some of these changes have no doubt been simulated by hysterical patients. Whether the secretion has come from the sebaceous glands or sweat-glands has not been clearly demonstrated, probably from the former. T. H.

XERODERMATA.

Ichthyosis simplex or *xeroderma*, dry skin, is frequently met with in children and adults. It is usually congenital, and often occurs in several members of the same family. The skin is always dry, harsh, and rough from fragments of cuticle. This change may exist in a very slight form or to a very aggravated degree, in which latter case it merges into the next disease, viz. *ichthyosis cornea*. The characters of *xeroderma* are modified in appearance in different regions of the body. On the face the epidermis is comparatively smooth, with but few ragged edges; on the neck it is rough, and has a branny appearance; and on the rest of the body the cracks of the epidermis correspond with the direction of the lines of motion of the corium. The pores of the follicles are prominent; the hair is either dry and brittle, or broken off on a level with the skin. There is generally a deficiency of subcutaneous fat and a loss of elasticity. The skin can be moved backwards and forwards, as if from a want of connecting tissue between the skin and the parts beneath. It is commonly soft on the neck and on the aspects of flexion, and hard on the hands and feet and on the aspects of extension.

Patients who are affected with this kind of skin do not usually enjoy very good health; they are said not to recover well from the exanthemata, and at times to suffer from palpitation after moderate excitement.

Treatment may relieve but seldom or never cures this affection, which is usually due to a congenital deficiency in the skin. Cod-liver oil and arsenic are often beneficial in improving the nutrition of that tissue. Frictions with fresh oil or glycerine are also useful; the stimulant effect of the friction may be increased, where prolonged friction is inconvenient, by the addition of from ten to thirty minims of croton-oil to four ounces of olive-oil.

Ichthyosis cornea or *hystrix*. In this disease dry and hard grayish or slate-

* The pigment is sometimes unevenly distributed, so that there is an excess of it in some parts and a complete loss of it in others.

† Dr. Laycock, *British and Foreign Med.-Chirurgical Review*, vol. xviii.

coloured scales appear on different parts of the body, unaccompanied by any redness or heat of skin. Its most frequent seat is the extremities, especially the outer aspect; it rarely occurs on the face. The scales vary in size and arrangement, being usually heaped one on the other irregularly, never distinctly laminated; they are sometimes collected at special points, and form small horn-like processes or round shield-like projections. The scales constantly drop off and are at once renewed. Sometimes separate scales are not visible, but the skin is covered with a dense hard dark-coloured coating, like shagreen, which is divided by deep furrows into small angular compartments or masses. The surface of the skin beneath is rough and rather hard, a condition dependent on hypertrophy of the papillæ. When limited to part of a limb, the density of the scales is often very great, and they are at times very dark-coloured from an excess of pigment.

The scaly masses peculiar to this disease are due to an abnormal formation of altered cuticle. Mr. E. Wilson, however, considers them hardened sebaceous substance.

Hardened sebaceous secretion, forming squamous layers or rough almost horny prominences, are occasionally met with, and have been described by different writers under different names. Bateman's 18th plate, in his *Delineations of Cutaneous Diseases*, which depicts what he calls ichthyosis faciei, seems to represent a case of this character. It is called by Professor Hebra seborrhœa sicca, and by Cazenave and Professor Hardy acné sébacée concrète and acné sébacée cornée. These cases have led to confusion, and seem to have induced Mr. Erasmus Wilson to call even true ichthyosis cornea by the name of ichthyosis sebacea squamosa and ichthyosis sebacea spinosa, names only suitable for cases of spurious ichthyosis.

The true nature of the cases which really depend on altered sebaceous secretion can be ascertained by removing the scales or horny concretions, when the enlarged orifices of the sebaceous glands will be readily seen. This form of skin-affection will soon yield to warm baths and alkaline lotions. An interesting account of two cases of ichthyosis spuria vel sebacea is given by Dr. J. W. Ogle, in the 46th volume of the *Medico-Chirurgical Transactions*.

True ichthyosis in its two forms, I. simplex and I. cornea, is often hereditary. In the well-known Lambert or porcupine family* the disease, in an aggravated form, was hereditary for four generations, and was strictly limited to the male sex. Other cases have been recorded where it was confined to the female members of a family; and another where it affected a man, did not affect any of his children (three sons and three daughters), but affected four out of five grandsons, and spared his only two granddaughters; the seven grandchildren being the offspring of two of his daughters.†

Treatment. Alkaline baths will remove many of the thicker scales; they are, however, speedily re-formed. Mercurial ointments and lotions of corrosive sublimate in almond emulsion have been recommended after the scales are removed. Arsenic has been often given, but it is doubtful whether much benefit has been obtained from its use.

T. H.

DISEASE OF THE HAIRS.

Plica polonica (*der Weichselzopf*, Germ.). This is a disease of the scalp which is endemic in Poland, Livonia, some parts of Russia and Tartary, beyond which countries it is scarcely known.

The real nature of this disease is not yet clearly proved. What is visible to the naked eye is a firm matting together of the hairs, and the presence of

* *Philosophical Transactions*, 1731.

† Sedgwick, *Brit. and For. Med.-Chir. Review*, vol. xxvii. 1861, p. 478.

a sticky material between them. The matted hair sometimes takes the form of a single long tuft, sometimes of several smaller tufts, and sometimes of an irregular mass, forming a kind of cap. The disease is usually confined to the head; but is sometimes met with on the chin, in the axillæ, and on the pubes. There is pain and great tenderness of the scalp, which bleeds on the slightest touch.

It is doubtful what is the source from which the sticky material between the hairs proceeds. Fuchs believed that it came from the hair-follicles; G. Simon regards it as an abnormal secretion from the surface of the skin, not especially implicating the follicles. When it is examined microscopically, it is found to be made up of epidermis, threads of cotton, silk, and wool, with particles of sand, insects, &c. Sometimes, especially in cases of long standing, cryptogamic vegetation is found amongst it. The older writers described the hairs as thickened, swollen at the roots, and infiltrated with sticky reddish or reddish-white fluid. Later writers have not confirmed these observations. G. Simon* found no change in the hair, either at the root or in the shaft; it was not brittle or infiltrated with any abnormal material. He could not find, as stated by Günsburg, any vegetation in the hairs themselves.

On chemical examination, the peculiar matter has been found to consist of extractive matters, with ammoniacal compounds, fats, and fatty acids; with some salts, especially chloride of sodium, sulphate, phosphate, lactate, and acetate of soda; with but little potash, magnesia, iron, and silica. These analyses throw no light on the nature of the disease.

It has been suggested by Hebra,† that plica polonica is not a distinct disease, but eczema, or other skin-affection, much neglected. This theory obtains some plausibility from the circumstance that in Poland there is a popular prejudice that this condition of the scalp is a cure for other maladies. On the other hand, it is not confined to the poor and ignorant, and is met with beyond the limits of Poland.

T. H.

WILLIAM JENNER, M.D.

THOMAS HILLIER, M.D.‡

PART II. LOCAL OR SURGICAL AFFECTIONS OF THE SKIN AND ITS APPENDAGES.

CORNS.

CORNS in their origin are merely local hypertrophies of the epidermis, situated for the most part on the feet, occasionally upon the hands, and more rarely over the prominences of the elbows or knees.§ They are produced by intermittent pressure or friction, localised either by the natural prominence of the part affected, or by the peculiarities of the exciting cause.

Thus, on the feet they are produced by the irritation of ill-fitting boots. These, either from being too small, subject the most prominent points on the foot to undue pressure, or more generally, from being misshapen or too large, chafe and irritate the feet in walking. The peculiar distortion of the toes

* *Die Hautkrankheiten*, p. 388.

† *Medicinische Centralzeitung*, 6 Feb. 1850, No. 11.

‡ The sections of this essay signed T. H. are by Dr. Hillier, the rest by Dr. Jenner.

§ A case is related of a corn occurring on the tongue at King's College Hospital, under Mr. Hulke's care. *Med. Times and Gazette*, 1861, p. 556.

occasioned by short shoes,—namely, the extreme contraction of the flexor tendons, the doubling under of the extremities of the toes, and the dislocation of their phalanges on the dorsal aspect,—this predisposes to the formation of corns. Arising from this cause, they usually occur on the flat ends of the toes, which press downwards against the sole of the boot; or on the dorsal surface of one of the phalangeal joints, which, being unnaturally prominent, are thereby exposed to friction against the upper-leather. In a less degree tight stockings are a cause of corns, by crowding the toes and hindering the even spread of the foot in walking. On the hands these growths may occur upon the palms or upon the knuckles: they may be produced by the friction of the thimble in tailors and sempstresses. In such as play upon the harp and violincello they are often found on the palmar surface of the finger-ends and thumb; and more rarely the friction of the pen in writing will be sufficient to produce them on the second finger or thumb. Again, the peculiarities of certain manual occupations may excite their growth upon the prominences of the knees or elbows.

From the occurrence of corns in very young children as soon as they begin to walk, and from their prevalence in certain families where both parents are sufferers, it cannot be doubted that a predisposition to their growth may be communicated by hereditary transmission. As has been mentioned above, intermittent and frequently repeated irritation, by friction or pressure, of a certain degree, is required for the production of a corn. This acts by stimulating the cutis to the formation of an undue amount of epithelium, forming the characteristic thickening of the cuticle. Should the irritation, however, be excessive, either in its degree or its duration, effusion of serum between the cutis and cuticle takes place, and a blister instead of a corn results.

Corns may be broadly classed under the terms *hard* and *soft*. The hard may be either flat and horizontally laminated in their structure, or fibrous and vertical in the arrangement of their parts. Again, in various stages of their development corns differ in their connexions with surrounding tissues.

If a hard flat corn be examined in its earliest condition, it will be found to consist of a simple thickening of the cuticle, not well defined in extent, in shape somewhat like the flat head of a nail, and composed of epithelial scales, condensed, and having a regular horizontal lamination in their arrangement. By maceration such a corn may be completely separated from the cutis, leaving the subjacent papillæ distinct and well defined, and in no way altered from their normal condition. In its further progress the growth becomes more clearly circumscribed, and, increasing in thickness, produces greater pressure on the parts beneath. In old-established corns, situated over the phalangeal joints of the toes or some other prominent point of bone, this pressure and continued irritation generally gives rise to the formation of a bursa beneath, though the occurrence of a subjacent bursa is by no means an invariable consequence.

From the examination of corns that have evidently existed many years, and have from time to time been subjected to treatment, it appears that the long-continued pressure and frequent removal of the upper layers of the cuticle may at length lead to complete absorption of the papillary structure of the skin. Such corns may be found based upon the fibrous tissue of the sheaths of the extensor tendons of the toes, all intermediate structures having been absorbed.*

The progress of corns, the pain they occasion, and their ultimate result, differ with the varying intensity of their exciting cause, and with the different plans of treatment adopted for their cure. Thus, excessive irritation from pressure or other causes may excite inflammation and suppuration in the cellular tissue or bursa which often lies beneath. The matter in these cases gene-

* Cruveilhier, in tom. iii. p. 927 of his *Pathological Anatomy*, says he has never seen the corn penetrate the subjacent articulation.

rally finds exit by bursting, the thickened epithelium may scale off, and a cure result; or the matter, before bursting externally, may find its way into one of the phalangeal joints, giving rise to a small but troublesome perforation of the articulation. Occasionally the suppuration of a corn, its bursting, and the consequent exposure of the deeper parts, will lead to loss of one of the phalanges by necrosis. There is at the present time in the wards of St. Bartholomew's Hospital a patient who, from a perforating ulcer originating in a corn, has lost by necrosis the first phalanx of the little toe, together with the distal end of the corresponding metatarsal bone.

Treatment, when not followed by cure, may modify the progress of the disease, by exciting in some cases inflammation, ulceration, or sloughing of the part; such effects being for the most part caused by the application of various escharotics. The ordinary practice of cheiropodists—namely, that of cutting out the centre of the corn deeply, leaving the circumferential part, and protecting the centre from pressure by properly adapted plasters—often produces a change in the structural arrangement of the growth. Thus, the central hole may become filled up by what is termed a fibrous corn; *i. e.* a corn with a vertical arrangement of its epithelium, which ensheathes a few elongated and sensitive papillæ. By maceration the two parts of the corn may easily be separated; the vertical or fibrous portion coming out like a plug, and leaving a clean hole in the surrounding laminated and thickened epithelium. Another effect of frequent cutting is the permanent depression of the centre of the corn considerably below the level of the surrounding skin, and coincidently with this change there is absorption of the cutaneous papillæ.

The common pearly yellow hue of corns is due to simple condensation of the epithelium. Occasionally minute hæmorrhages take place into their substance, either from some unusual irritation of the cutaneous papillæ, or by injury to their extremities by cutting, or in attempts to extract the corn. The centre of the growth may thus acquire a bluish-black tint, popularly supposed to be the root of the corn, and upon the extraction of which the professed corncutter specially prides himself.

Fibrous corns. These might more properly be called warts, since in them the papillary structure of the skin predominates. They consist generally of a few elongated papillæ ensheathed by epithelium, rough on the surface, and more sensitive to pressure than the ordinary corn. They are situated for the most part on the balls of the toes or soles of the foot, rather than on the dorsal aspects of the phalanges; nor have they, in such specimens as the writer has examined, any underlying bursa.

Soft corns are found generally between the toes, and most frequently upon the fourth toe, on one or other of its lateral aspects. They differ from hard corns in being more sensitive and vascular, in the greater rapidity of their growth, and in many of them possessing a pretty distinctly papillary structure. The constant moisture to which they are exposed from their position causes them to become spongy and condylomatous in their appearance. Indeed, many that pass under the name of soft corns upon the feet would, if found in the neighbourhood of the anus, be recognised as condylomata. Not a few have broadly overhanging edges overlying the sound skin around, seemingly the effect of pressure upon their soft and spongy texture. Occasionally a bursa is found beneath them.

These corns are liable to the same accidents as the harder variety; they may inflame, ulcerate, or suppuration may take place in the bursa or sub-cutaneous tissue beneath them, giving rise generally to a minute central aperture through which a serous fluid oozes for long after the escape of the matter.

In addition to the ordinary and most obvious inconvenience attached to corns, namely, pain, increased by warm or moist weather, and generally most annoying during the spring-time, there are the more serious evils of suppuration and ulceration; the latter being generally a sequence of the former, or in some cases resulting from the indiscreet application of caustic irritants

to the corn. In patients with languid or deficient circulation, where, either from want of power in the heart or from disease of the arteries of the limb, the standard of nutrition is too low to resist the ulcerative process, the ulcer may form the starting-point of a slowly progressive gangrene.

Less obviously, though not less certainly connected with these growths, are many cases of lateral curvature of the spine; generally commencing in early life, and taking their origin from a habit of throwing the weight of the body in walking to one side, in order to relieve the pain of a corn on the opposite foot. Among the same class are rare instances of cramped and difficult action of the muscles of the leg and foot, which may excite suspicions of a failure in the nervous energy of the patient, but are really due to the habitually constrained movement of the limb in the attempt to "favour" a painful corn.

Treatment. *Hard corns* in their earliest stage will often disappear if the irritation that produced them be removed, and this may generally be traced to the wearing loose, ill-fitting, or patent-leather boots, or it may be simply to the habit of wearing the same boots many days in succession. The application of a drop or two of glacial acetic acid with a camel-hair brush every night will disorganise the cuticle, which may then be picked off with the point of a knife or scissors, or the corn may be rubbed down with a corn-file. The cuticle may be softened for rubbing down by the application of lint steeped in a solution of carbonate of soda, and covered with oiled silk. It is well, after the removal of a corn in the foregoing manner, to protect the part for a time by wearing over it a small patch of diachylon plaster.

When, from a day of unusual exertion, or from any other cause, a corn becomes inflamed or more than ordinarily painful, it may be covered at night-time with a small patch of wet lint with oiled silk over it; this both relieves the pain and gives an opportunity in the morning for removing the growth entirely.

The use of nitrate of silver in substance is strongly recommended by some Surgeons; it should be applied after the thickened epithelium has been pared down, or, better, picked off; the scale of blackened cuticle which it produces is said to separate in a few days, leaving a smooth and healthy surface if the corn has not penetrated too deeply. Some discretion must be exercised both as to the condition of the corn (whether inflamed or otherwise), and as to the extent to which this remedy is applied; its injudicious use may produce considerable suffering.

Old-established hard corns are seldom cured, since the patient is unwilling to submit to the restraint and inconvenience of the necessary treatment. Occasionally an illness which confines the sufferer to bed for some time rids him of his corns, or they may disappear in the desquamation following scarlatina.

It is notorious that, as the expression is, those who "attend to their corns" suffer but little inconvenience from them; while among those who suffer most are such as visit cheiropodists at prolonged intervals and purchase for themselves a few weeks of ease at the cost of as many more of suffering. In the treatment of old-established hard corns it may be well first to soften the cuticle by the application of wet lint and oiled silk during some hours; when it is soft and pulpy an incision may be made with a small sharp knife completely surrounding the centre of the growth, or the same incision may be effected with a succession of snips with the points of a pair of scissors. Having completely circumscribed the corn, its centre may be raised with a fine hook or a pair of forceps, and the included piece may be removed by cutting under its base; each incision being of small extent, or it will cause pain. The margins of the opening left by the removal of the corn may be slightly bevelled off, and a plaster applied made of soft thick buckskin or amadon spread with adhesive material; a hole being cut in the plaster corresponding with the extent of the corn, and the outside margins of the plaster being bevelled off with a sharp knife.

If it be thought sufficient to protect the corn from pressure without pre-

viously removing any of its substance, the centre of the growth may (as recommended by Sir B. Brodie) be covered with a piece of linen rag or thin diachylon to prevent it bulging through the hole in the corn-plaster.

Suppuration beneath a corn may be recognised by the intense pain and throbbing of the part; it should be relieved as soon as possible by puncture, the cuticle being previously softened by the application of warm-water dressing. In favourable cases where the circulation in the foot is healthy and vigorous, the opening of an abscess beneath a corn is frequently followed by complete disappearance of the growth; in others, either from general debility or local deficiency in the circulation, this perforation gives rise to a chronic and intractable form of ulcer. Such a sore is best treated by invigorating constitutional remedies; and among these, opium in small doses is generally most effective; locally some stimulating application, such as resin-cerate or turpentine-ointment, may be used with advantage.

Soft corns seem to owe their existence to the friction of one toe against its neighbour, and their more rapid growth to the warmth and moisture of the locality where they are for the most part found. Unless in a state of inflammation, these corns may generally be cured by the application of the oxide of zinc in powder, or equal parts of this and the pulvis æruginis may be dusted over the growth, and the toe be surrounded with a thin wrapping of cotton-wool; after a few applications the corn will either dry up and disappear of itself, or its shrivelled remains may be cut away without pain or inconvenience. The application of the glacial acetic acid will be found very useful in the treatment of soft corns. But whatever plan be adopted for the cure of the disease, the affected toe should be kept apart from the others by the daily application of cotton-wool.

There are certain corns which, from their situation and cause, require a separate mode of treatment; such are those arising from contraction of the flexor tendons, with doubling under of the ends of the toes and unnatural prominence of the phalangeal joints on their dorsal aspect. The corns from this cause are situated either on the extremity of the toe or on one of the joints on the dorsal surface. In these cases the toes must be straightened, either by strapping the toe or toes to a gutta-percha splint placed on the plantar surface, by division of the flexor tendon, or by winding a piece of linen rag or adhesive plaster over the dorsum of the prominent toe and beneath the toes on either side.

Those whose feet are habitually predisposed to corns, or who suffer serious inconvenience either from the number or pain of these growths, should wear boots made from some other material than leather. As a substitute for leather nothing is so good as the invention that rejoices in the classical but ungrammatical name of *pannus corium*. This, from its softness and pliability, is particularly suited to tender and irritable feet. Persons liable to corns should carefully avoid wearing patent-leather boots, as hindering the escape of the cutaneous transpiration.

BUNIONS.

The term 'bunion' is applied to enlarged bursæ situated on any part of the tarsus, metatarsus, or phalanges of the toes; but for the most part placed over the metatarsal joint of either the first or fifth toe, and accompanied with more or less distortion of the subjacent articulation.

To study rightly the exciting cause of this disease, it may be well to revert for a moment to the natural form of the foot uninfluenced by the distortion produced by modern boots and shoes. Perfectly formed feet may be seen in the many shoeless children of the London streets. If such be examined, it will be found that, as regards general conformation, the foot is widely spread towards the toes, that the inner line of the foot and great toe is nearly straight, or as Professor H. Meyer more accurately expresses it,* the

* "Procrustes ante portas," by H. Meyer, translated by J. S. Craig, Edinburgh.

central longitudinal axis of the great toe carried backwards passes through the centre of the heel. There should be moreover a considerable interval between the first and second toes along the whole of their contiguous margins; the second and third toes are also separated, though by a narrower interval; nor do the third and fourth toes touch each other when the weight of the body is borne on the foot.

Comparing with this the foot of an adult that has been distorted by the purely conventional shape of modern boots or shoes, we may observe, first, that, from lateral pressure and crowding, all the toes are in close contact with each other, and not infrequently the second or third toe overrides or is doubled under its neighbours, or the little toe is doubled under the fourth toe, so that on the dorsal aspect of the foot its root is but just visible. From the same cause the toes all incline towards the middle line of the foot; this distortion particularly affecting the great toe, which, instead of remaining in a right line with its own metatarsal bone, turns obliquely away towards the outer side of the foot; so that if the line of its longitudinal axis be carried backwards, it would fall altogether to the inner side of the heel.

The above-mentioned distortions are easily accounted for by the narrowness of the sole of modern boots, which crushes up the toes into a bunch; and the sloping of the inner side of the boot towards the middle line of the foot, thus constantly exercising pressure on the inner side of the great toe and thrusting it over towards the outer side of the foot. Boots again very generally by their shortness press on the end of the same toe, pushing it directly backwards, thereby increasing its distortion from the right line, and this, by bearing on the head of the corresponding metatarsal bone, causes the latter to project on the inner side of the foot. In addition to the direct effect produced by the pressure of misshapen boots, the material of which the boot is made may exercise a predisposing influence on the formation of bunion; patent-leather, as it is called, or any material which, like it, completely stops the evaporation of the transpiration from the cutaneous surface, has this effect.

There exists undoubtedly in many persons an hereditary tendency to the formation of bunions, a predisposition in which even the most carefully constructed boots will fail in averting the formation of these growths.

Though generally situated over the first joint of the great toe, as the part exposed to greatest irritation, yet it is by no means rare to find bunions developed over the prominence of the scaphoid bone, or again on the outer side of the foot over the proximal or distal end of the fifth metatarsal bone, and elsewhere on the dorsum of the foot over any bony prominences where the unnatural conformation of the part fails to correspond with the artificial and arbitrary shape of the shoe.*

In its early formation, a bunion generally attracts attention as a painful and tender spot over one of the metatarso-phalangeal joints previously exposed to pressure and irritation by distortion of the corresponding toe. By and by the part enlarges, indicating an effusion into an already existing bursa,† or the formation of an adventitious synovial cyst. This effusion, though the result of inflammation, is generally recognised as designed to protect the sub-

* Through the kindness of Mr. E. James, of the Melbourne Hospital, we are enabled to quote the following remarks of Dr. George Bennet, of Sydney, in answer to an inquiry by the writer of this article:

"Sydney, March 1861.

"With respect to the distortion of the feet of the natives of this country, I have observed neither in the aborigines of Australia, nor among the natives of the Polynesian Islands I have visited, any of the distortions you allude to as seen on the feet of the civilised races who encase them in shoe-leather. Nor have I seen among the natives corns or bunions."

† For an exhaustive enumeration of natural bursæ, vide Schreger, *De Bursis mucosis subcutaneis*.

jacent parts from pressure. At this point the disease may cease to make progress; the bursa may remain; and may effect the object to which we have just alluded, occasionally reminding the possessor of its existence by a passing twinge of pain. Far more frequently the bursa, though an efficient protection, reserves to itself the irritation it wards off from the joint beneath; the consequences of this are seen in repeated attacks of pain or inflammation, causing progressive enlargement; or it may be in the formation of callosities or corns on its surface, or in suppuration of the contents of the cyst. The evacuation of the fluid from the interior may be followed by obliteration of the cavity and cure of the disease; but in old people, or in those of languid circulation, it may give rise to a most troublesome form of ulcer.

The perforating ulcer of a bunion has for the most part a pallid indolent appearance, and secretes a pretty abundant sero-purulent discharge. If a probe be introduced, it will generally be found that the size of the external orifice bears no proportion to the cavity of the sore, which latter is relatively very large, and extends some distance beneath the margins of the ulcer; occasionally there is a fistulous passage from the bottom of the sore communicating with the joint beneath.*

Coincidentally with the distortion of the joint, which precedes or accompanies the formation of a bunion over the base of the great toe, there are changes to be observed in the conformation of the articular ends of the bones, in the cartilage, ligaments, and tendons, in connexion with the joint. The head of the metatarsal bone enlarges, and is often encircled at its margin by bony deposits; the articular cartilage is almost invariably absorbed, and the bone beneath eburnated. The internal lateral ligament is elongated; and the external so shortened, that if in the dead body an attempt be made to restore the toe to its natural position, this ligament tears. The extensor tendon of the great toe is dislocated to the outer side to a greater or less extent, and in extreme cases the sesamoid bones will be found to have shared in the general displacement, being dislocated with the phalanges of the toes towards the outer side of the foot.

It may be questioned whether these changes in the joint, which are analogous to those occasioned by chronic rheumatic arthritis, are directly the effect of the distortion, or whether they are not rather occasioned by that disease occurring in the joint in question as the "*locus minoris resistentiæ*," as it has been called. This is the more probable from the known tendency of gout to attack the same joint, and it may be for the same reason.

Treatment. It is only in the early stage of bunion that treatment will avail for the complete removal of the disease, though palliative measures are practicable at all times.

The tender spot that precedes the formation of a bunion may be advantageously covered by night with wet lint and oiled silk, while by day a more commodious boot than usual should be worn to free the part from pressure, care being taken that the boot or shoe be wide in the sole, and not sloped off on the inner side towards the median line of the foot. If the part be very tender, it may be covered during the day with soap-plaster spread upon kid or washleather.

So soon as a cyst has formed, in addition to the above-mentioned precautions, means should be taken to procure the absorption of its contents, either by the occasional application of strong tincture of iodine, or the continual application of the compound mercurial cerate upon linen rag, the margins of the swelling being protected with some soft plaster. For the cure of bunions when uninfamed, and for such as have much fluid within them, we have found an ointment of biniodide of mercury most useful; it should be applied occasionally, or at least not so constantly as to blister the skin. The strength we would recommend for this purpose is ten grains of the salt to an ounce of lard.

* This affection is the "*mal perforant du pied*" of French authors.

On the occurrence of inflammation in the sac of a bunion from any cause, water-dressing, or a poultice, will be found the most comfortable application. A careful watch should be kept for any sign of suppuration, since should it occur, an early and free incision is both requisite for the relief of pain, and is often followed by the complete cure of the disease. It is often the habit of persons suffering from severe bunion and distortion of the toes, to wear boots made to fit accurately their distorted feet. Professor Meyer recommends in such cases the wearing of a shoe so constructed as to tend to restore the toes to their natural position. He says, "the sole should be cut exactly as if the toe were in its proper position;" questioning, however—and we think with reason—how far such an expedient would be advisable in cases of very extreme distortion of the joints, or prominence of the enlarged bursa.

The difficulty of healing the ulcer resulting from the bursting of a bunion is sometimes very great, especially in old people, or in those whose circulation is languid from other causes. A stimulant local application, such as the resin or turpentine-cerate, will generally be found useful; while the use of opium and stimulants internally, with easily assimilable and nutritious diet, is called for. If, as is generally the case, the ulcer have a small external orifice and deeply undermined and overhanging edges, they should either be destroyed by caustic, or they may be laid open by a crucial incision, or be removed entirely by scissors. Under the most judicious treatment, however, these ulcers, in persons of feeble circulatory powers, or where the arteries of the foot are extensively diseased, may form the starting-point for senile gangrene.

WARTS.

Warts, or verrucae, are collections of overgrown cutaneous papillae, either completely ensheathed by an excessive formation of scaly epithelium, or each papilla of the growth stands beside its fellow separate, having only its natural cuticular sheath.

Verruca simplex, the most common form of wart, consists of a bundle of hypertrophied papillae, closely adherent, and ensheathed by a thick covering of cuticle: from friction and exposure to the air its surface is generally horny in texture, and is rounded off into a small button-like protuberance. This species of wart is found solitary or in large numbers, chiefly in young persons, and is situated most usually about the hands or fingers, occasionally on the face, and more rarely on other parts of the body.*

Verruca digitata is a name applied to a less common variety of wart, situated almost invariably on the hairy scalp. On examination, it will be found to be formed of a few cutaneous papillae imperfectly ensheathed by cuticle. This wart is more pedunculated in its attachment to the surface than the foregoing variety; its papillae are long, and often free at their extremities, giving the surface of the growth a ragged appearance. It is found, as stated above, generally on the scalp, and so far as one's own experience extends, only in women after adult age: such warts, either from their number or from some unfortunate peculiarity in the position of a single growth, may give rise to great pain and inconvenience in brushing or combing the hair.

Subungual warts. Warts very similar in structure to the foregoing occasionally form beneath or at the side of the finger or toe nails. Situated here, they are generally softer in texture and more rapid in growth than those on the scalp. They originate beneath the nail from the sensitive skin to which the nail is attached between its free margin and the *real* matrix; and in their further growth they generally crop-out either at the free extremity or margin of the nail. Such are apt to be very painful and inconvenient.

* A case is related of a wart of this kind occurring on the tongue. *Medical Times and Gazette*, 1861, p. 556.

Verruca confluens is a term introduced by Mr. Erasmus Wilson to designate a variety of warts found on various parts of the body, chiefly over the neck and upper part of the thorax, or the backs of the hands or arms. The growth in question consists of an aggregation of closely-packed but distinct papillæ, often smooth on its surface, and without any evident indication of the isolation of its component papillæ; but on pinching up the skin of the part its surface will break up into minute fissures showing its papillary structure, which bears a resemblance, in M. Rayer's opinion, to coarse plush.

These growths are of uncertain size and shape; they may occur in patches or irregular bands. Either spontaneously, or more generally under some local irritation, they may extend pretty rapidly over the surrounding skin; their advance in any direction being usually preceded by the enlargement, here and there, of outlying and isolated cutaneous papillæ.

Differing in some respects from ordinary warts are those of venereal origin. Such are more vascular in their structure, are often of fleshy consistence, and pedunculated in their attachment to the surface. If those that have existed some time be examined microscopically, their bases will be found to include portions of the structure of the deeper layers of the skin; namely, a dense network of areolar tissue and more thinly scattered elastic fibres: in this particular they resemble old condylomata, and in this they differ from common warts, which consist only of papillæ and their epithelial covering. Venereal warts often have comparatively large blood-vessels entering their under surface. Such warts, from the warmth and moisture of their position, situated (as they usually are) beneath the foreskin or between the labia, grow more rapidly, and attain a larger size than other varieties, propagating themselves abundantly by contact with neighbouring parts.*

Causes. Though occasionally congenital in their origin, warts are notoriously capricious in their appearance, period of duration, and disappearance. Some individuals exhibit an hereditary tendency to their formation, and not a few are affected with warts corresponding in position exactly to those existing in one of their parents.

Mr. Sedgwick gives an account of a family under his observation, where warts on the hands have been hereditarily limited to the female line for two generations. The mother herself was much troubled with numerous warts on her hands, which appeared in infancy, continued through childhood, and disappeared soon after puberty. She had five children: a boy æt. 11, a girl æt. 9, a girl æt. 7, a boy æt. 5, and a girl æt. 2½: the two boys never had a wart; the three girls are all troubled with them—the eldest has thirty warts, the next daughter has twenty-four on the hands. In both, the warts appeared in infancy, and have increased in number since. The youngest child has two warts at present.†

The period of life between infancy and puberty seems particularly that in which warts grow most luxuriantly. *Verrucæ* may suddenly appear either singly or in large numbers; such eruptions generally attacking the hands and wrists; they may remain a longer or shorter time, and as rapidly and unaccountably clear off. Adults but rarely suffer in this way, though we recently observed a very copious eruption of warts over one side of the neck and upper part of the chest in a lady about forty years of age. They were very numerous, and a few weeks had elapsed since she noticed their commencement; they varied greatly in size, some being but just visible, while others were as large as swan-shot. More recently, a professional friend showed me a large crop of common warts of various sizes, which had appeared without apparent cause upon his own hands, none of them having existed more than four or five weeks.

* We have seen in a child warts precisely similar in appearance to the venereal, growing from the commissure of the lips, and lying within them when the mouth was closed.

† *Brit. and For. Med.-Chir. Rev.* April 1863.

The irritation produced by certain discharges, especially by such as are of venereal origin, is a well-known and generally acknowledged cause of one form of wart; and no less certain is the occasional effect of soot in the production of the malignant wart of chimney-sweepers.

From the frequent occurrence of distinct warts, or warty thickenings, upon the hands of persons occupied in post-mortem investigations or in the study of practical anatomy, it is more than probable that the poison of decomposing animal matter under certain conditions is capable of exciting the formation of these growths. At all events, one's personal experience, and that of many of our pathologists and demonstrators of anatomy, lends support to this opinion.

Some warts are undoubtedly contagious, and especially those of venereal origin, and such as occur from other causes about the genital organs; next to these in their aptitude to spread by contact are such as occur in crops about the hands.

It is a popular belief that the blood from a wart is capable of reproducing others when applied to the external surface of the body; and a case has recently appeared in the French journals tending to confirm the popular prejudice. M. Cruveilhier states that M. Banuel showed him a band of warts upon the back of the hand, assuring him that they had sprung up in the line of the stream of blood flowing from one of these growths during its removal.* But M. Rayer states that "he has repeatedly tried to inoculate warts in this manner; but the operation has never succeeded."† Unintentionally one has several times performed the same experiment, and always with a negative result.‡ As one would suppose, such warts as furnish a secretion from their surface, manifest most decidedly their contagious character; but that this peculiarity is not confined to such, I may refer to a case related to me by Mr. Paget, where an individual with a small and completely dry wart on the foreskin, which had existed for some years, and who had suffered from no venereal affection within many years, married, and communicated to his wife a most abundant crop of warts, which affected the labia and parts about. She in the mean time suffered from no discharge, either leucorrhœal or gonorrhœal. The original wart in the husband underwent no change either in size or appearance, nor did it furnish any palpable secretion.

Progress. The capricious and sudden disappearance of warts has given rise to a belief in the efficacy of charms for their removal. But it is rare for any but the common wart that affects the hands of young people to disappear in this way; and this may account for the fact that wart-charms have but little reputation for the cure of these growths when of venereal origin.

The common wart of the external integument may remain for many years, or a life-time, without materially increasing in size; its growth, however, may be stimulated by some permanent source of local irritation; indeed, warts that in their commencement differ in no recognisable feature from the *verruca simplex*, may in their subsequent progress assume a character in no way distinguishable from epithelial carcinoma; such are usually situated on the face. For an interesting and detailed account of the structural changes occurring in their degenerations, the reader is referred to a paper by Dr. Collis in the *Dublin Quarterly Journal* for May 1860.

The production of horns by the excessive growth of warts, with the dessication of their external layers of cuticle, will be considered under the head of "Horns."

Treatment. Warts that are dry in their texture and but scantily supplied with blood, such as the *verruca simplex* and the scalp-wart, may generally be

* *Anatomic Path. Générale*, tom. iii. p. 926.

† Rayer, *On Diseases of the Skin*, p. 982.

‡ I am acquainted with a gentleman who intentionally performed the same experiment, and with apparent success; a wart forming on the back of the hand where the blood was applied.

easily removed by some chemical solvent; perhaps one of the most efficacious and manageable of these is the glacial acetic acid; it also has the advantage of being painless in its action. It may be applied with a camel-hair brush to the wart until its texture is pretty thoroughly sodden with the acid, care being taken to prevent the blistering of the skin in the neighbourhood; the application may have to be repeated once or twice. Nitrate of silver in substance is a popular but unsightly remedy. Tincture of the perchloride of iron is generally effectual, but is better suited for the cure of warts that are moist and secreting. The application of a drop of the strong nitric acid, or acid nitrate of mercury, is exceedingly efficacious, and causes less pain than is generally supposed.

Vascular pedunculated warts of venereal origin may be removed at once by the knife or curved scissors; or if too vascular or bulky for this remedy, the application of some drying powder, such as the oxide of zinc, or equal parts of this and the diacetate of copper, or a mixture of equal parts of powdered savine and diacetate of copper: any of these constantly applied will either remove the growths entirely, or bring them into such a condition that they may be safely removed by the knife. Some discretion must be exercised in applying the knife to large crops of warts of long standing or considerable size, situated upon either the glans penis or internal labia, as troublesome or even dangerous hæmorrhage may occur; of this, examples not infrequently occur in the venereal wards of our hospitals. In my own experience I have been compelled on one occasion to apply the actual cautery to the glans penis to arrest the hæmorrhage caused by the removal of a mass of verrucous growths; the bleeding in this case was most formidable in quantity, and quite uncontrollable by other means used for its suppression. In many cases of very bulky pedunculated and vascular warty masses, such as affect the external genitals of women, and more rarely those of men, the *écraseur* of Chassaignac will be found a convenient and safe instrument for removing the disease. The warty thickenings that occur on the hands from the contact of post-mortem fluids are best treated by the free application of the acid nitrate of mercury. An ingenious method has been devised by Mr. Nesbitt, of Wolverhampton, for the removal of pedunculated warts by the application of an elastic ligature. A thin india-rubber thread, such as may be drawn out from an old brace, or a small elastic ring, is applied to the base of the growth, so as to constrict it pretty tightly, though not painfully. In a few days the wart will generally dry up and fall off.

For the cure of congenital warty growths which affect large portions of the skin, and for those described under the term '*verruca confluens*,' the free application of the strong nitric acid is necessary; or the growth, if small, may be excised with the portion of skin upon which it is based. Occasionally it is advisable, in order to avoid loss of the integument, to shave off the papillæ composing the wart with a sharp knife, and to brush the surface over lightly with nitric acid.

The most effectual and speedy cure of warts is by excision of the growth itself, together with the integument upon which it grows; and this is the safest manner of treatment for rapidly growing or degenerating growths, or any which excite a suspicion of a malignant character.

From the situation of subungual warts upon the fingers or toes it is difficult to apply caustics, or to remove the disease by excision; where this is the case, the papillæ composing the growth may be pulled out separately by means of the forceps—a proceeding easy of execution, and causing but little pain.

HORNS.

Differing but little in their elementary composition from warts, horns, by their different structural arrangements, and by the greater exuberance of their growth, present but little external resemblance to these growths. True horns consist of scaly epithelium, more or less condensed and dessicated, for

the most part containing within them a fibrous-looking papillary core derived from the true skin, and consisting of extremely hypertrophied papillæ, each thickly ensheathed and separated from its fellow by a condensed cuticular covering. These are supplied freely at their base with blood-vessels, which penetrate some distance up the centre of each. They form the matrix from which layers of cuticle are continually being formed and pushed onwards.* Such horns may be called "papillary." They are marked externally by longitudinal lines, are rough and fibrous-looking, and generally taper towards their ends, their free extremity being often finely pointed. As might be supposed from the large growing surface presented by the papillary core, these horns are often very rapid in their growth, and attain to a larger size than any other variety. They grow generally from the free surface of the skin, being immediately connected with it.

Another type upon which horns are formed is where they grow from a vascular matrix, flat, or very slightly projecting beyond the level of the skin, and sending no prolongations into the interior of the horn itself, which in this case is formed entirely of epidermis in various stages of condensation. These horns are generally marked by annular constrictions at pretty regular intervals; they have a tendency to curve or become spiral, and bear, for the most part, a greater resemblance to the horns of the smaller ruminants than the papillary variety.

These horns, moreover, from the more horizontal lamination of their component parts, more readily break off and more easily crack transversely; while the papillary horns, from their fibrous arrangement, split longitudinally at their extremities, but break off with difficulty. Perhaps the best examples of the former description of horn are met with growing from the matrix of the toe-nails, or from the interior of sebaceous cysts, where, indeed, they attain their largest dimensions.†

There is in the Museum of the Royal College of Surgeons an anomalous specimen of a horn formed of compact bone, ensheathed by a covering of horny matter; the bone within the horn apparently has no continuity of tissue with the skull. The parentage of this growth seems to be uncertain, since it is described in the catalogue as "*supposed* to be an excrescence from a human scalp." Bony projections from the exterior of the skull, having the external appearance of horns, but being connected with the bones of the skull, are not true horns but exostoses, and are generally of the variety termed "ivory."

From tabulated accounts of cases of horny growths,‡ it appears that out of 151 cases, 81 occurred in females, and 70 in the opposite sex. From the same tables one may gather the comparative liability of certain regions of the body to these growths. Thus, of 142 cases, 63 grew from the head; 32 from some part of the lower limb; 23 from the trunk, on one or other of its aspects; 16 from the face; and 8 from the glans penis. In addition to these, we may take into consideration horns growing from the toe-nails, which are by no means rare among those old women of the poorer classes who jealously guard their feet from the contact of water.

Origin of horns. A generally acknowledged and common source of human horns is from the interior of sebaceous cysts, such as frequently affect the hairy scalp. They may arise from the interior of an unruptured cyst, and bursting through the cyst-wall may continue their growth external to it; but far more frequently the horn takes its origin from the secreting surface of a cyst that has either burst spontaneously or been accidentally ruptured. Such

* For a good description of the minute structure of these horns, see a paper on human horns by Mr. A. M. Edwards, *Edin. Med. Journal*, November 1859.

† For an excellent description of the structure and manner of growth of this variety of horn, the reader is referred to Mr. Erasmus Wilson's work on *Diseases of the Skin*, p. 621.

‡ Erasmus Wilson's *Diseases of the Skin*, p. 624; where also is a reference to a paper by M. Lozes in *Mém. de l'Académie Royale de Médecine*, juin 1830.

may grow with extreme rapidity, the exposure to the external air having the double effect of stimulating the increased secretion of epithelial matter, and of rapidly drying that already formed to a horny consistence.

A growth, differing in its structure in no material particular from the horns of sebaceous origin, is often found growing from the matrix of one of the toe-nails, being most frequently situated on the great toe. They may be found from one to four inches in length, tapering at the point, and often curved spirally like a ram's-horn. In these growths, the layers of epithelium forming the nail, instead of lying, as is natural, parallel to the long axis of the phalanx, lose their horizontal arrangement, and becoming more vertical, turn upwards as they are pushed forwards from below by the growing matrix.* The exterior of these horns is dense and partially translucent, having the appearance and consistence of horn; the interior is composed of epithelium, less condensed, and easily separable into layers. Cruveilhier considers that the pressure of the bed-clothes in old and bed-ridden people gives rise to these growths by irritating the matrix of the nail. The best specimens that I have seen of this form of horn have been among old women who have presented themselves as out-patients, in whom, therefore, this cause could not have been in operation. Moreover, it may be generally observed that these horns turn outwards, lying over the tops of the other toes, their direction being influenced by the shape and dimensions of the shoe.

The papillary horns, as they are called, in their commencement differ but little from some of the dry kinds of wart; indeed, it is more than likely that many of these growths are of warty origin. Mr. Erasmus Wilson denies the possibility of this mode of origin, in opposition to Cruveilhier.

In the College-of-Surgeons Museum is a specimen "of a horny growth from a wart on the hand." It is about three inches or more in length, about an inch in diameter at its base, and has a longitudinally fibrous structure; it is an undoubted horn. I myself removed a small horn, about half an inch in length, attached to the integument of the neck from a woman in whom I had the opportunity of watching its origin in the form of a small wart.

Horns are occasionally found in connexion with epithelial cancer, and generally grow from the thickened and tuberculated skin at the margin of the cancerous ulcer. Cruveilhier cites a case of this kind connected with the lower lip. A patient presented himself at St. Bartholomew's Hospital with a recurrent epithelial cancer of the heel, connected with which was a horny growth in the form of a large flat boss, which on removal proved to be true horn.† Analogous to horny formations of this kind are such as are occasionally met with in the keloid disease of cicatrices, and in chimney-sweeps, connected with cancerous warts.

Treatment. The only efficient treatment for these growths is by complete removal, together with the portion of the skin upon which they are based; or if springing from the interior of a sebaceous cyst, the whole of the cyst should be dissected out. Such as grow from the matrix of the toe-nails are best removed by a fine saw, if too dense for the knife; the nail being subsequently pared away to its proper shape and dimensions. Any subsequent tendency to exuberant growth from the same part can be checked by the application of the glacial acetic acid, which possesses the property of dissolving epithelial structures.

BOIL.

Furunculus, or boil, is a circumscribed inflammation of the skin and subcutaneous areolar tissue, attended by a local effusion of lymph, and followed

* A good example of such a growth is seen in St. Bartholomew's Hospital Museum, series xxvii. species 24.

† A case is related by Mr. Hutchinson in the *Pathological Transactions* for 1857, of a horn growing from the angle of the mouth; the base of this eventually became the seat of a papillary epithelial cancer.

by the death of the central portion of the involved tissue ; and this, the core, is subsequently expelled through an opening in the cutis, together with the degenerated products of the inflammatory process.

Among minor differences, which are chiefly those of degree, one may distinguish pretty clearly between such boils as are lumpy, definite in extent, and prominent on the surface, and such as are flat and less defined in their outline.

(a) *The ordinary boil.* The former of these varieties generally commences as a lump beneath the skin ; at first perhaps but little sensitive ; this as it increases in size seems to irritate the surrounding tissues, producing pain and heat about the parts ; at the same time, the external swelling becomes more pointedly conical, and acquires a bright-red blush on the surface. The pain is now more considerable, and is of a piercing, throbbing character, occasionally varied by a distressing sensation of tension and weight at the part affected, the surface of which is now exquisitely sensitive to the slightest external irritation. It is probable, as has been suggested, that the sloughing process is during this time extending through the dense structure of the true skin ; since before long a purulent spot appears at the apex of the swelling, and coincidently the local suffering is considerably diminished. This pustule, or vesicle, after a slight increase in size, bursts, and gives exit to a little sanious pus, and discloses a narrow opening leading straight through the cutis, to a greenish-yellow slough beneath. After a variable interval, the slough becomes loosened, and presents itself at the cutaneous orifice, which appears far too small for its convenient exit ; through this, however, it makes its way—a small shreddy wad of dead tissue, soaked in inflammatory products. The subsequent progress towards recovery is rapid ; the flask-shaped bed of the boil for a day or two discharges some sanious shreddy pus ; then quickly fills up with granulations, and cicatrisation takes place, leaving behind a small, depressed, and slightly-discoloured spot.

Boils are considered by some to be confined to the true skin, and not to affect the subcutaneous tissue ; the core, or slough, is also said to be almost entirely composed of inflammatory products.* In this opinion we cannot coincide. The slough, or core, if examined microscopically, will be found to consist of the elastic and fibrous elements of the deeper layers of the true skin, matted together by lymph in various stages of disintegration.

(b) *The flat, more diffuse*, or, as it is termed, the “blind” boil generally commences in a small inflamed pimple, surrounded by a red and exquisitely tender areola, ill defined in its margins. The pain of such a boil is from the first of a throbbing nature, keeping time with the pulsation of the heart, and is greatly increased in severity by any excitement of the circulation, such, for instance, as follows the administration of any diffusible stimulant.

The pimple in the centre of this form of boil either very slowly pustulates, or, more generally, forms a vesicle containing blood-stained serum ; and on the giving way of the cuticle, this is discharged with a little shreddy sanious pus, and with far less solid slough than separates from a common boil. The blind boil also, so far as our own observation extends, seems to belong to a more atonic and debilitated state of system than the ordinary lumpy boil. Occasionally boils spontaneously disappear without proceeding to suppuration ; such are generally slow in their formation, and cause but little pain.

For the most part, the progress of a boil is not attended by any constitutional fever, nor is their eruption preceded by any distinctive premonitory symptom ; yet not infrequently individuals who have had much experience of boils in their own persons, can anticipate the appearance of each fresh visitor by the occurrence of a certain feeling of general discomfort and chilliness ; while in others, the eruption is preceded by a transient irritability and querulousness of temper.

* A clinical lecture by Mr. Syme, *Lancet*, March 8, 1856, p. 269. Rokitansky makes the same statement, *Path. Anatomy*, vol. iii. p. 85.

Boils may be stated to be in almost every case local manifestations of certain constitutional conditions. It is usual in treating of analogous affections, first to treat of the general causes and symptoms which produce and precede the local malady. But since no distinctive group of general symptoms can be pointed out as indicative of an approaching eruption of boils, we have ventured to reverse the order commonly observed in the systematic description of disease, and shall proceed from the description of the characteristic and constant symptoms of the local malady to the consideration of the less definitely marked conditions of the constitution at large, which precede and apparently occasion the eruption. We adopt this course, hoping thereby to eliminate some rational indications of treatment, not so much for the boil itself, as for the conditions of the system that determine its appearance.

Among the causes of boils, it is generally recognised that certain atmospheric conditions largely influence the predisposition of the population at large to this disorder. Thus, as a matter of certainty, we know them to be more prevalent during the spring and early summer than in the autumn and winter. Again, during certain years boils have prevailed in this country epidemically; they did so in the years 1851, 1857, and 1858, when their appearance could not be connected with any unusual atmospheric condition of which we have any cognisance. There are, however, certain conditions of the system which exercise a definite influence in the production of boils; such a condition is induced in the majority of patients under the hydropathic treatment, as it is called. Here an alteration in the patient's diet (for the most part in the direction of greater simplicity), the diminution or deprivation of stimulants, copious draughts of water, a greatly increased secretion from the skin and kidneys, will sooner or later almost unfailingly produce a general eruption of boils.

Again, a constitutional condition highly predisposing to boils is induced in those who subject themselves to the training process which prize-fighters and athletes undergo, and which is necessary for those who row in races. The general experience of persons in the better classes of society seems to be, that the more out of condition they are when the training-process is commenced, and the harder they train (as the expression is), the more liable are they to boils; *i. e.* the more sudden and the greater the change in their diet and general regimen, the more liable are they to boils.

Here, again, the condition of the blood predisposing to boils is induced by an alteration of the diet both in quantity and quality, by the unusual muscular exercise producing an increase in the urinary and cutaneous secretions, and a rapid metamorphosis of tissue.

The long-continued slow absorption of certain animal poisons by inhalation will in very many people, not thoroughly acclimatised to the atmosphere of dissecting-rooms and pathological theatres, produce what we term the furuncular diathesis. For confirmation of the above statement we would refer, without fear of contradiction, to those whose duties compel them to a daily and prolonged attendance in the atmosphere of a dissecting-room; and to such as doubt the relation of cause and effect in this case, we would say, under a strong and painful personal conviction of the truth of the above statement, "*experto crede.*"

The contact of certain cadaveric emanations and animal secretions is, so far as we are aware, the only local cause which is of itself sufficient to cause boils; such boils, or at least the first of the crop, being situated on the part to which the poison has been applied. It is not uncommon in making a post-mortem examination where the wrists and hands come freely in contact with the fluids of the corpse to feel a peculiarly stinging sensation on the surface; and in a period varying from a few hours to a few days afterwards, one or more boils may in such a case (or where no such sensation has been experienced) appear on the surface of the hand or forearm. These boils generally commence in one of the hair-follicles on the hand or forearm, these being the spots where the poison finds most ready access to the surface of the cutis.

A statement has recently been made by Mr. Gamgee concerning the influence in the production of boils of certain animal poisons taken in the shape of food.*

He states "that the flesh of animals affected with pleuropneumonia, when eaten by man, causes boils and carbuncles to an incredible extent. My observations," says Mr. Gamgee, "were made in three establishments; one where fifteen hundred persons were known to be supplied with diseased meat; another where several hundred soldiers were in the same position; and a third where seventy persons fed too often on the flesh of diseased animals."

It would be interesting to know the exact data upon which Mr. Gamgee founds this statement.

It is a matter of experience familiar to many that mere changes of diet, and especially the more liberal supply of animal food to those accustomed hitherto to a scanty supply, will not infrequently bring about an eruption of boils. We see this exemplified in the case of young persons leaving their homes in the country and coming to the metropolis or elsewhere as domestic servants; such persons, "servants in their first place," as they are conventionally termed, are peculiarly liable to boils until they become used to the more liberal scale of diet.

There is a curious but unexplained relation existing between the diabetic diathesis and that which precedes or accompanies the eruption of boils: on the one hand, these latter are notoriously frequent in persons suffering from diabetes; and on the other, Prout, Wagner, and others have related cases of transient diabetes occurring during the outbreak of boils.† We have examined the urine in several cases, but have failed to confirm these observations. In addition to the probable causes of boils enumerated above, there are many and various circumstances producing a condition of general constitutional debility, during which the patient may be attacked by boils; such as prolonged lactation, measles, scarlatina, and the continued fevers. But the conditions to which we have alluded more at length furnish examples where the cause and effect bear more evident and constant relation to one another.

From the above considerations it would seem that the appearance of boils cannot always be connected with that condition of the system which passes under the sufficiently indefinite term 'debility;' nor can these eruptions be usually ascribed to mere alterations of quantity in the blood—to conditions of anæmia and plethora; but it seems probable they are more often due to some change in the quality of the circulating fluid.

In the instances cited, we have either the definite introduction of some poison into the system, through the lungs in those employed in dissecting-rooms, through the alimentary canal in those consuming diseased meat; or its application to the external surface of the body, as in the case of the boils of pathologists. Or we may suspect the presence of some abnormal constituent of the blood, as in the boils accompanying diabetes and pyæmia. In other cases we have cited, there is such a change of diet and general regimen as to favour the supposition that the quality of the blood has been altered by a change in the proportionate quantities of its normal constituents.

In persons predisposed to the formation of boils from constitutional causes, the exact seat of the malady is in many cases determined by some local irritation producing transient congestion of some spot on the external surface. Thus those who, by training for rowing, have acquired a predisposition to the disease, will generally suffer on the parts most exposed to local irritation—this part, from the nature of the exercise, being generally the buttock.‡ In others,

* "The Diseases of Animals in relation to Public Health," *Edinburgh Veterinary Review*, 1863, p. 258.

† M. Vulpius has recorded a case of temporary diabetes during the progress of a carbuncle. *Gazette Hebdomadaire*, 1860, No. 49.

‡ In rowing the palms of the hands are more exposed to irritation than the buttock; but they are parts of the body exceptionally exempt from this disease.

the friction of the braces as they pass over the shoulders will localise a boil. Again, the forehead, just where fretted by the rim of the hat, is a favourite spot for their occurrence; and the nape of the neck, where chafed by the shirt-collar, is another. Again, we have seen boils on the back of the first knuckle of the thumb in those employed in cutting out cloth, from the pressure and friction of the scissor-handles.

Among other sources of local irritation, the application of a blister is occasionally followed by a crop of boils on the part; a poultice in some has the same effect, especially if kept long applied; croton-oil liniments in others will localise the disease; and the application of a piece of soap-plaster, as mentioned by Dr. Watson, has been known to be followed by a succession of boils.

In many cases, however, no local cause can be assigned, and these pests may invade capriciously almost any part of the body; in our own experience we have known two instances of boil on the penis—one on the dorsum, and one on the under surface. Mr. Coulson has met with one on the dorsum of the foot; and they are not infrequent on the backs of the hands and fingers, while the palms of the hands and soles of the feet happily seem altogether exempt from the disease, and the hairy scalp is not often affected, though it is by no means exempt.

The structure of the integument of the part affected exercises a considerable influence over the character and progress of a boil. In the axillæ, the perineum, and parts where the subcutaneous tissue is loose, boils are, for the most part lumpy, elevated, and clearly circumscribed in their boundary, and the core is earlier and more easily discharged than from those situated over the thick leathery integument of the nape, and the dense skin on the outsides of the forearms and thighs. In these parts the swelling is less prominent, more diffuse, and the slough slowly and more painfully separates from its subcutaneous connexions.

In infants and young children boils are infrequent; and if they occur, their ordinary progress is somewhat modified, especially if the child be fat; the death of the cellular tissue is more extensive, and the loss of skin by sloughing greater; the disease in its course and termination more resembles the phlegmon of young children.

The local mischief occasioned by boils is for the most part transient, though the cicatrix is often permanent, since the skin, at the central point of the swelling, is not merely perforated by the escape of the core, but suffers loss by sloughing. Twice only has it fallen to our lot to witness any serious or permanent local injury. In one of these cases, a stricture resulted from a boil situated on the under surface of the penis; in the other, the sloughing during the progress of a boil laid open the sheaths of the flexor tendons of the hand, just above the annular ligament of the wrist. This accident led eventually to destructive suppuration of the wrist-joint.

The effect of boils on the constitution at large cannot but vary with the state of the general health at the time of attack. From the consideration of some of the known causes of boils, one may venture to conclude that their action is in certain states of the blood eliminative, though their frequent occurrence, from the amount of suppuration and discharge accompanying them, and the pain they occasion, may induce or increase a condition of general debility. A more serious, but happily an infrequent, effect of boils is the purulent infection of the blood and the production of pyæmia. Of this the following will serve as an instance:—A gentleman aged forty-six, who had suffered many times before from boils, was attacked with one on the back of his hand, which, contrary to his usual custom, he allowed a surgeon to open by incision. In a few days he was well enough to go out of doors; but the day following he was attacked by pain in the chest and dyspnoea; this was

* I am indebted to Mr. Edward Newton, of Fitzroy Square, for the particulars of this case.

followed a day or two later by intense pain in the left hip-joint, severe constitutional fever, pain and swelling of both wrist-joints, increase of the dyspnoea, and death three weeks after the opening of the boil. The post-mortem examination disclosed an abscess in the left hip-joint, turbid fluid in both wrist-joints, and numerous pyæmic abscesses scattered throughout the lungs.

Treatment. In considering the constitutional treatment generally adopted for boils, we shall for convenience separate the rational remedies, as they may be called, from the empirical.

When the cause of the attack is assignable with some degree of certainty, there is a definite indication of the line of treatment most likely to prove successful. Thus, boils resulting from the slow absorption of poisons emanating from decomposing bodies in dissecting-rooms or elsewhere, are best treated by the early administration of a laxative, by procuring a free excretion from the skin by means of the Turkish bath, warm-baths, hot-air or vapour baths, or, better still, by muscular exercise in the open air; and by a liberal and mixed supply of nutritious food with stimulants in moderation.* In such a case, if a tonic seem desirable, quinine, with mineral acid or some preparation of bark, will be found most suitable.

The indications for treatment are also definite where boils are occasioned by a sudden change either in the quantity or quality of the food; and in such instances the remedies naturally suggested by the circumstances of the case are for the most part successful. In such it may generally be observed that the diet has consisted chiefly of some one class of food, to the exclusion, either partial or complete, of some other; or that the crop of boils has been preceded by some system of diet and regimen which enforces either a complete abstinence from, or a very restricted use of, alcoholic stimulants. We are here referring particularly to the scale of diet adopted by persons under training, or the hydropathic system.

If, in contradistinction to these systems, we observe the effects of a well-selected and sufficiently-varied scale of diet on a number of individuals of various ages and both sexes, the contrast is striking. Mr. Gover, resident medical officer at the Millbank Prison, informs us that he imagines there is scarcely any establishment of equal size in which boils are so infrequent as at that prison. Out of a population of 1000, they scarcely have a dozen cases in a year. "I presume," says Mr. Gover, "that this is due to the compulsory regularity in the habits of the prisoners, the attention paid to cleanliness, and to the fact that the diet, while not in excess, contains every element in due proportion."

The condition of the urine often furnishes a satisfactory guide to the plan of treatment most suitable to the case—we mean an alkaline reaction, or one of abnormal acidity. The saccharine condition of urine, which has been found associated with boils by some observers, suggests a dietary theoretically appropriate; in practice, however, its adoption has not been followed by any marked success.

The effects of prolonged lactation, the convalescence from fevers or other exhausting diseases,—all of these conditions present sufficiently appreciable deviations from the standard of health to afford a guide to the treatment of boils resulting from them.

But there still remains a large number of cases in which either no definite cause can be assigned for the attack, or in which, though the cause be recognised, the rational plan of treatment has not proved successful. To such cases the various *empiric remedies* are applicable; and first among these remedies we would rank *yeast*, both on account of our complete ignorance of its action on the animal economy, and from the beneficial and speedy effect it apparently exercises in a certain limited number of cases. It may be taken

* During the progress of a boil, and before it has burst, stimulants, if given in large quantities, may much increase the pain.

fasting, a tablespoonful at a time, three times a-day; and its use need not be continued longer than a fortnight or three weeks; since its effects, if beneficial, are soon evident.

Quinine, given in the manner recommended by Dr. Jackson of the United States,* may be reckoned an empirical though successful remedy. Dr. Jackson's plan is the following: he gives from "twelve to sixteen grains of the sulphate of quinine, divided into three or four doses, on the first day; and if the peculiar effects of the medicine on the head and ears do not take place, he increases the quantity next day by four grains; and continues to increase the quantity daily by four grains, until there is some evidence that the patient has got as much as he can comfortably bear. On the day after some inconvenience is occasioned by the medicine, the daily quantity is diminished by four grains. If this is borne well, or whatever daily allowance is borne with ease, is continued for four or five days, and then gradually reduced to two grains in a day." Dr. Jackson recommends that the quinine should not be entirely given up for three or four weeks, and insists on the necessity of beginning with large doses, so as to make a distinct impression on the system as early as possible.

Acids or alkalies are occasionally administered empirically; that is, when there is no particular indication of their being required; they are in such cases given in large doses, and are generally combined with some tonic.

Local treatment. The list of local applications for boils, starting from the time-honoured prescription of the prophet, which is still popular among the poor, includes substances many in number, and very various in their nature and consistence; and first, of the reputed curative measures.

Boils may be subjected to treatment of an abortive kind, and occasionally so with some success. Whatever remedy be employed with this object in view, the period when it is likely to prove successful is only in the very early stage of the boil's existence, and, so far as our personal experience extends, chiefly in the case of blind boils.

This variety may often be quenched early by the application of nitrate of silver, in the solid stick, to the part of the swelling where the vesicle is about to form: a drop or two of the strong liquor ammoniæ applied to the same part is said to have the same effect; and strong tincture of iodine is recommended for the same purpose. *Incisions* are highly extolled for the abortive treatment of boils by Dr. Jackson, whose work we have quoted above; he recommends the boil when it is but two or three days old, and but a "pimple," to be split with a knife. Mr. Hunter,† Mr. Syme,‡ and many others recommend incisions as limiting the extent of the disease, diminishing the pain, and hastening the cure. All agree in advising that the incision, to be efficacious, should be complete, and employed early. We cannot but think that the employment of incisions for boils is of questionable advantage, as a general plan of treatment; it is seldom that the case is submitted to medical inspection until all hope of an abortive incision is at an end; and we question very much if the advantages claimed by Mr. Syme for his method of local treatment would willingly be purchased by most patients at the cost of the short, though sharp, pang suffered during the division of the boil: there are, however, exceptional cases of severe local pain where an incision may be practised with great relief to the patient's suffering. *Poultices* are applications which give some relief from the pain, and quicken the process of suppuration; at the same time they tend to increase the extent of the boil, and favour the formation of fresh ones in the neighbourhood; if used at all, they should be small. Water-dressing is a better application of the same kind, as being more easily localised.

* *Letters to a Young Physician*, Boston, 1855.

† Hunter, *On the Blood*.

‡ A clinical lecture by Mr. Syme, *Lancet*, March 8, 1856, p. 269.

An application which has great repute as a domestic remedy for boils is the bark of the slippery elm; a piece of this soaked in water forms a soft mucilaginous pulp, which, applied to the part, has much the same effect as a poultice. *Boils*, unless exceptionally painful, or occurring on very incommo- dious parts of the body—where their rapid suppuration and speedy recovery is all important—are best simply protected from external injury by some unirritating form of plaster spread upon leather; soap or lead plaster spread upon kid or chamois leather is an excellent application until the boil has burst, when perhaps the emplastrum or ceratum resinæ are more suitable from their stimulant properties.

CARBUNCLE.

Anthrax or carbuncle is a specific form of local inflammation attacking the subcutaneous tissue and involving the skin; it is attended by effusion of unorganisable lymph, followed by sloughing of the central and deeper parts, and subsequently by destruction of the skin and the separation of the dead tissues in the form of a slough.*

It may be distinguished from a boil by being less clearly defined in its margins, less conical at the centre, for its size less prominent on the surface, and by its manner of perforating the skin by several apertures. At the same time it extends more deeply than a boil, the redness of the skin is of a more livid hue, the pain is more severe, and is accompanied by more constitutional disturbance. Again, unlike boil, it generally occurs singly, and for the most part affects certain localities; it belongs especially to certain periods of life, and its slough differs in its colour, consistence, and attachment to surrounding parts from that of a boil.

Carbuncle shows a decided preference for the male sex; out of 2818 deaths from carbuncle during fourteen years, namely, from 1847 to 1860 inclusive, taken from the Registrar-General's Reports, but 784 were females.

The disease has notoriously been more prevalent in some years than in others. The deaths registered from this cause gradually increased in number from the year 1847, when they were 77, to 1854, when they reached 300. Since the latter date, they have fluctuated between 255 and 235 per annum. In the year 1860 they were 247.†

These fluctuations in the yearly death-rate have occurred unconnected, so far as we can discover, with any unusual or peculiar atmospheric condition. The deaths have occurred from this disease chiefly among the middle-aged and those more advanced in life, being most frequent between the ages of 45 and 55.‡

The common form of carbuncle is rarely met with under the age of twenty; while that variety to which we shall presently allude under the name of malignant or facial carbuncle, generally occurs in persons under thirty years

* For a summary of the various opinions concerning the pathology of carbuncle, see a paper by Mr. Ledwich, *Dub. Quar. Journ.* November 1856; also *Dub. Quar. Journ.* February 1864. Mr. Syme, *Lancet*, 1856, vol. i. p. 269, states decidedly that the disease "is not subcutaneous, but seated in the skin itself." Having carefully read his description of carbuncle, we must conclude that it differs in some points from the actual phenomena of the disease as it occurs in London.

† In the Registrar's tables the numbers stand thus:

Year.	Males.	Females.	Total.	Year.	Males.	Females.	Total.
1847 ..	50 ..	27 ..	77	1854 ..	218 ..	82 ..	300
1848 ..	58 ..	33 ..	91	1855 ..	177 ..	78 ..	255
1849 ..	64 ..	17 ..	81	1856 ..	192 ..	61 ..	253
1850 ..	102 ..	32 ..	134	1857 ..	175 ..	77 ..	252
1851 ..	112 ..	49 ..	161	1858 ..	181 ..	65 ..	246
1852 ..	167 ..	66 ..	233	1859 ..	169 ..	67 ..	236
1853 ..	190 ..	62 ..	252	1860 ..	179 ..	68 ..	247

‡ Address by Mr. A. Pritchard, *Brit. Med. Journ.* August 8th, 1863.

of age. The disease attacks all ranks of life; the upper classes being quite as liable to it, if not more so, than the ill-fed and over-worked poor.

The causes of carbuncle may be generally stated to be purely of constitutional origin, and to depend, when any cause can be assigned, upon conditions of general debility or plethora; while not rarely, individuals are met with, who without showing any perceptible deviation from the standard of health, exhibit what may be called the carbuncular diathesis,—an unfortunate predisposition to the disease. Many causes have been assigned as tending to produce carbuncle, while some have considered it of purely local origin.^{*} It is, however, quite impossible with certainty to assign any particular combinations of antihygienic conditions as the predisponents of carbuncle.[†]

Still, from the frequent association of this disease with the gouty diathesis, one is warranted in entertaining an opinion that there is more than an accidental connexion between the two, and we believe that in the same way that gout is popularly, but not altogether falsely, divided into the “rich man’s” and the “poor man’s” gout, so might carbuncle be often traced to the effects of opposite hygienic conditions acting on the gouty diathesis.

By some the prevalence of carbuncle during the last few years has been attributed to the more extended use as an article of food of the flesh of animals affected with pleuropneumonia and splenic apoplexy, diseases which during the same time have been increasing in frequency among stall-fed cattle. On this point Professor Gamgee makes a statement to the effect that he has traced the prevalence of boils and carbuncles to the use of diseased meat in certain establishments where this kind of flesh is largely consumed as food.[‡] Recorded facts, however, are wanting to establish the accuracy of this statement.

Dr. Livingstone on the same subject writes, “when the flesh of animals that have died of pleuropneumonia is eaten, it causes a malignant carbuncle; and when this appears over any important organ, it proves rapidly fatal. It is more especially dangerous over the pit of the stomach. The effects of the poison have been experienced by missionaries who had partaken of food not visibly affected by this disease.

“Many of the natives who persisted in devouring the flesh of animals which had died of this distemper, died in consequence. The virus is destroyed neither by boiling nor roasting.”

On the other hand, cases are recorded where the flesh of animals that, by external contact, produced malignant pustule in one individual, was eaten as food by others with impunity.[§] The same author relates an instance of two butchers who were attacked with charbon after having killed and dressed the carcass of a diseased ox, which, as an article of food, proved both wholesome and savoury.^{||} Again, the flesh of sheep affected with carbuncular disease is eaten largely in Scotland, and that with impunity.[¶]

The question of the wholesomeness, or the contrary, of the flesh of diseased animals as an article of food, and its capability to cause carbuncle, is at present *sub judice*; and until those who attribute carbuncular disease to this cause can adduce facts in proof of their assertions, we may fairly state that their case stands “not proven.”^{**}

Seat of carbuncle. The disease is most usually situated on the back of the trunk or neck, occasionally encroaching on the hairy scalp, on the buttocks, or the extensor surface of the limbs, on the upper or lower lip; its favourite

* Address on Surgery by Mr. Pritchard.

† See report on carbuncle, *Med. Times and Gaz.* 1854, p. 567.

‡ The passage is quoted at length in the section on “Boils.” See also some remarks by the same gentleman, *Lancet*, 1864, vol. i. p. 187.

§ Bourgeois, *Pustule maligne*, p. 73.

|| Ibid. p. 165.

¶ *Med. Times and Gaz.* 1863, p. 564; also 1864, vol. i. p. 217.

** We do not of course allude to parasitic diseases.

seat being in the dense and fibrous integuments over the posterior median longitudinal line of the body. Carbuncles have been observed on the front of the abdomen and on the sides of the thorax. As a rule, they appear but one at a time, though they may follow one another in succession. Through the kindness of Mr. Wood of Shrewsbury, we are enabled to quote an exceptional case where the patient at one time suffered from eight; this gentleman had, on a previous occasion, been attacked by carbuncles. He was a free liver and a large, very large eater, and he eventually died almost covered with carbuncles, having at the same time four on the back, one on the nates, two or three upon the abdomen, and one on the thigh; they were many of them very large.

A carbuncle, as it generally occurs, begins in a painful inflammatory swelling of the integuments, hard to the touch, red in colour, very obtusely conical in shape, and ill-defined in its boundaries; it gradually increases in extent and hardness, diffusing itself through the surrounding cellular tissue as a kind of inflammatory cedema. After a few days the colour becomes darker, the more prominent parts being of a livid red, where the cuticle is generally raised from the cutis by some sanious serum; on the bursting of this vesicle the cutis is seen to be perforated by several small yellow apertures which give exit to a glutinous purulent fluid. After a time these separate holes, from the death of the intervening skin, merge into one large ragged-looking opening. At the bottom of the cavity thus exposed is seen a slimy, pultaceous slough, extending into the interstices of the surrounding cellular tissue beneath the sound skin, and possessing, as some think, a characteristic fœtor. During all this time the inflammatory cedema around may have been extending; but on the full exposure of the slough it generally begins to subside, the pain lessens in intensity, suppuration commences, and the dead parts slowly and, as it were, reluctantly separate from their connexions, leaving a cavity of very irregular shape, having generally deeply undermined and jagged edges. In the progress towards cure, this is filled-in by granulations up to the level of the skin, and when cicatrised leaves an uneven and often permanently discoloured scar.

The ordinary progress of carbuncle, as above described, may occupy an uncertain interval of time extending from a fortnight to some months; indeed, in a few instances, the vitality of the skin for a long while resists the sloughing process which takes place in the tissues beneath, giving rise to a chronic carbuncle, where the slough is both slow to form, and when formed is for a time imprisoned by the integuments; such carbuncles, if opened, have the appearance of an abscess with semi-solid contents.

The slough consists of the subcutaneous cellular and fibrous tissues, abundant oil-globules, and the products of the inflammatory process in various stages of disintegration. The depth to which it penetrates is uncertain; but not infrequently on the separation of the dead parts the muscles below are seen completely bared, or even to some extent involved in the sloughing. To such a depth may the disease extend, that a carbuncle on the anterior abdominal wall may produce fatal peritonitis.*

Death may occur in this disease from exhaustion caused by the sloughing and discharge from the carbuncle; these, however, alone rarely produce sufficient depression of the vital powers to cause death; more frequently, if death occurs in this manner, the fatal exhaustion has been occasioned or aggravated by hæmorrhage from incision of the carbuncle.

When the disease invades to any extent the hairy scalp, death may occur in the same manner and from the same cause so frequently seen in erysipelas of the head; the fatal issue being conventionally attributed in these cases to cerebral effusion, or inflammation of the membranes of the brain.

By far the most frequent and efficient cause of death in carbuncle is pyæmia, as characterised during life by rigors, profuse sweats, and general

* *Brit. Med. Journal*, August 8th, 1863, p. 152.

depression, and occasionally by the formation of external abscesses, and as evidenced after death either by multiple deposits of a fibrino-purulent nature in the liver, lungs, kidneys, and spleen, or by secondary abscesses in the same organs or elsewhere.* During the progress of the carbuncle the urine is thought by many to be saccharine. Cases of this kind have been recorded by Prout, Wagner, and M. Vulpian. But we believe this may be merely a coincidence, as we have been unable to find glucosuria accompanying the attack of carbuncle, nor was this condition of the urine found to exist in thirty-five tabulated cases reported in the *Med. Times and Gazette* for 1854, p. 569.

Treatment. Since such conflicting opinions exist on the subject of the local treatment of carbuncle, and as Surgeons of eminence and experience take such strong and opposite views on the question, we shall briefly allude to the most common plans of practice. At the same time we venture to suggest that some of the warmest supporters of particular and exclusive methods of treatment seem to pay but little heed to the collateral circumstances of each particular case, and the general condition of the patient.

And first, there are those who advocate and practise incisions of various kinds, as exercising a direct effect in the limitation of the disease both in its duration and extent.

Secondly, those who repudiate incisions and advocate various kinds of caustics, ascribing to these a similar effect.

Thirdly, there are those who make use of local applications, of a more simple and less heroic kind; and, distrusting the efficacy of both caustics and incisions as means of limiting the extent of the disease or hastening its termination, trust to the constitutional powers of the patient, and the general tendency of local inflammatory diseases to bring about a favourable issue. More recently a plan of local treatment by pressure has been introduced; it is said to limit the extent of the disease, to relieve the pain, and to hasten the separation of the slough.

1. The treatment by incision is adopted in the progressive stages of carbuncle; that is, at any time before the slough has begun to separate, or the inflammation to subside; it is probably the most popular plan of local treatment; and it generally consists in a free crucial division of the carbuncle from the surface towards the deeper parts, extending into the living tissues around and beneath.

An internal or subcutaneous crucial incision has been recommended by Mr. French. In this method a tenotomy knife, with its edge upwards, is introduced into the circumference of the induration; and the whole mass is divided from the deeper parts towards the skin, taking care not to wound the latter, except at the point of puncture; a second subcutaneous division is then made, in the same way, at right angles to the first. When the bleeding has ceased, Mr. French recommends that the surface of the carbuncle be covered with collodion, the slough being allowed to escape through the punctures in the base of the swelling.

Another species of subcutaneous division is employed by some; the parts being split horizontally. By others, the swelling is subcutaneously broken up, and subdivided with a long narrow knife passed in at the side.

2. The method of local treatment by caustic consists in the free application of caustic potash in substance to the centre of the tumour, until the latter is thoroughly disorganised. This plan has been highly recommended by Dr. Physic, and at his suggestion has been extensively adopted in America; while in this country, among others, Mr. Higginbottom and Mr. Pritchard have chiefly advocated the same treatment, which is thus described by the latter gentleman: "In whatever stage the carbuncle is, the potash is to be applied, and rubbed in freely in the centre until an eschar is fully formed.

* For instances of death by pyæmia from carbuncle, vide *Guy's Hosp. Rep.* 1861, p. 466.

In the earlier stages, if the skin is still unbroken, it must be used for several minutes, until the death of the central portion is insured; the size of the slough to be made varies with the size of the carbuncle. In general terms, the diameter of the skin to be destroyed should be a fourth, or even a third of the diameter of the indurated and inflamed mass." This, says Mr. Pritchard, is generally sufficient to stop the progress of the disease. Subsequently, the parts are to be covered with resin, turpentine, or camphor cerate; poultices being avoided. The circumference of the swelling may be covered with collodion, or a strong solution of lunar caustic. Strict cleanliness is to be observed; and the slough is allowed to separate spontaneously.

The advantages claimed for this plan of treatment are the following: the avoidance of hæmorrhage; a diminution in the extent and duration of the disease, and thereby a saving of strength to the patient; and a freedom from pyæmia.*

3. Coincidentally with a wide-spread and increasing belief in the general tendency of local inflammatory diseases towards spontaneous recovery, a doubt has arisen in many minds of both the efficacy and necessity of such remedial measures as have for their object the cutting short of the progress of a carbuncle. Thus it is that many Surgeons, formerly advocates for crucial incisions, are now content to allow the local malady to run its course; while by a judicious administration of constitutional remedies, they endeavour to husband the strength of the patient, and to place him in the best position to support the tax on his vital powers. This treatment is adopted on the conviction that neither local incisions nor caustics favourably influence the duration or extent of the disease; while by avoiding incisions, one source of danger—that of exhaustion by hæmorrhage—is altogether excluded; and this is no questionable advantage in old or enfeebled patients. At the same time, another perilous complication, that of pyæmia, is less likely to occur in this plan of treatment than in the case where incisions are employed.

The application of pressure as a curative agent to carbuncles was first advocated, we believe, by Mr. O'Ferrall,† who has since embodied his views and experience on this subject in a pamphlet. Strong testimony to the efficacy of this plan of treatment has also been given by Mr. M. H. Collis, in the *Dublin Quarterly Journal*, Feb. 1864.

The manner of applying pressure is thus described by Mr. O'Ferrall: "The compression must be firm, and must begin at the periphery of the swelling, and gradually approach its centre. In the early period of the practice, I was accustomed to apply a circular piece of brown soap-plaster, spread on leather or cotton cloth, leaving an opening for the discharge of the pus. This succeeded in many instances; but I found that a firmer support was necessary, in order to give immediate ease to the patient. I therefore covered this piece with straps of plaster, drawn tightly from the neighbouring sound parts, and they by traction exerted a firm degree of compression on the swelling. In some localities, where the tumour is of small size, and traction of the skin not easily accomplished, I have found a coating of collodion of considerable service, producing, by its contractile properties, a nearly similar result."‡

In reviewing the methods of treatment, we believe that that by incision has the advantage of very generally affording complete relief from pain; that it arrests the further extension of the inflammation is less certain; and we much doubt if the final cure is by it at all expedited.

Among the various kinds of incision for carbuncle, we have not been able

* Vide a comparison between the results of treatment by incision and by application of collodion, *Year-Book of Med. and Surg.* 1862, p. 165.

† *Dublin Hospital Gazette*, 1858, "On the Treatment of Anthrax by Pressure."

‡ *Ibid.*

to discover that any method possesses an advantage over the time-honoured crucial cuts. The treatment by incision has the disadvantage of causing hæmorrhage, and, it may be, of exposing the patient's life to increased risk from pyæmia; if employed after a carbuncle has ceased to make progress, this treatment may do damage by interfering with the natural process of cure, and by increasing the area of sloughing and suppuration.* No universal plan of incising carbuncles, as recommended by Mr. Syme, can be adopted without great danger to many sufferers from the disease. To the young and vigorous, the employment of the knife may bring relief from pain without risk to the general strength; while in the case of those who are debilitated by age or other causes, the questionable local advantages of incision are far outweighed by the certain risk incurred by the constitution at large.

As a local application after the division of a carbuncle, a poultice may be used, or, what is better in many cases, lint steeped in turpentine, spread over the surface; or if there is any tendency to continued hæmorrhage, the lint may be stuffed into the cuts with a probe.

Of the employment of caustics we have no personal experience; it is a plan strongly recommended by competent observers and Surgeons of high repute, who have had large opportunities for forming a sound and discriminating judgment on the subject. Of local applications to carbuncle (until the slough begins to separate), the most comfortable to the patient is the common linseed-poultice, or wet lint and oiled silk; the poultice is of itself too relaxing to many skins, and liable to give rise to boils in the neighbourhood; it is rendered more suitable to the particular malady by being smeared over with turpentine and resin cerate. Frequent syringing with warm water, a weak solution of chloride of zinc or of carbolic acid, will quicken the process of separation when the slough has fully formed; and occasionally from large carbuncles considerable masses of slough may be advantageously cut away with scissors.

To the granulating surface after the separation of the slough, some application of a stimulant kind is best suited, such as the Peruvian balsam or the cerate of turpentine and resin; while the edges of the cavity may usefully be approximated by careful strapping with plaster.

The constitutional treatment and general management of patients suffering from carbuncle is best conducted on general principles, and on such indications as the age, circumstances, manner of life, and standard of health of the patient afford, and not upon any specific or universal line of treatment directed to the particular disease.

The bowels, if they require attention, may be acted on by some non-irritating aperient; and the diet, if it be necessary to give much nourishment, should be given in an easily assimilable form. It occasionally happens that, starting from the carbuncle, an erysipelatous inflammation of the skin spreads to the parts around; this it is advisable to treat either by the application to the surface of strong collodion, or a paint recommended by Mr. Pritchard of Bristol, consisting of iodide of potassium and iodine, each a scruple, to one ounce of collodion;† or the strong caustic solution recommended by Mr. Higginbottom may be advantageously applied.

Facial carbuncle. Under this name we propose to describe a disease of carbuncular character, which often differs in its progress and consequences so much from the ordinary affection as to require a separate notice. Having most external characteristics in common with carbuncle; in its constitutional effects, this disease may be said to bear much the same relation to the latter as does scarlatina maligna to scarlatina simplex. Whether the fatal tendency

* Vide *Med. Times and Gaz.* 1854, p. 571, report on carbuncle.

† *Brit. Med. Jour.* 1863, p. 155.

of facial carbuncle depends upon the structural peculiarities* of the part affected or upon the essential nature of the disease, we shall not venture an opinion.

Facial carbuncle has been described, under the name of multiple furuncle of the face, by M. Dumereuil.† It has been alluded to as agminated furuncle of the face by Bourgeois, in his work on malignant pustule. In this country, as we believe, the disease was first described by Mr. Harvey Ludlow, in a paper entitled "Carbuncular Inflammation of the Lips and other parts of the Face;"‡ and this is by far the best account of the disease that is published. The cases published by Mr. Ludlow have been claimed by a recent writer on malignant pustule as instances of the latter affection.§ "The cases reported by Mr. Ludlow," says Dr. Budd, "are all characteristic examples of malignant pustule." From this assertion we venture entirely to dissent. In speaking of cases of facial carbuncle, M. Bourgeois, in his work on malignant pustule, states that it is not uncommon to meet with a fatal termination when carbuncle occurs about the mouth or other parts of the face; and that this disease is to be distinguished from malignant pustule by its painfulness, the presence of pus, the character of the swelling, and by other characteristics to which we shall presently allude.

In support of the opinion expressed above, we would direct attention to the following particulars: M. Bourgeois|| remarks of malignant pustule that its name is singularly inappropriate, since it conveys an idea of some purulent formation; whereas the secretion of pus is so opposed to the essence of the disease, that the recognition of the smallest quantity, in a doubtful case, would show the disease at once to be of some other nature than malignant pustule. At page 301 of the same work, among other diagnostic signs of malignant pustule, the complete absence of pus is enumerated, "since if it appear spontaneously, or follow upon pressure, one can say certainly that the disease is not of the nature of charbon."

On examining the six cases reported by Mr. Ludlow, we find that in five it is stated that pustules appeared on the surface of the part affected; while in the other case, when the diseased parts were incised during life, a thick pultaceous matter is said to have issued from the cut surface, which exhibited punctiform deposits of pus. Out of the five cases that presented external evidences of pus, four were cut into during life; and of these it is distinctly stated that there were isolated infiltrations of pus seen on the cut surface. In all these cases, therefore, pus was found to exist.

Of pain as a symptom of malignant pustule, M. Bourgeois remarks, that one important diagnostic sign of the disease is the almost complete absence of pain; and elsewhere, he remarks, a singular circumstance is the little pain these enormous swellings produce. While of Mr. Ludlow's cases it is related that one suffered "intolerable pain," another "suffered acutely," a third had "sharp throbbing pain," in another case the pain was "very severe," and in two cases the disease is said to have been "very painful."

These cases, therefore, differ from malignant pustule by possessing those very symptoms that are stated by Bourgeois to be characteristic of carbuncle of the face. In addition to this, at the time the cases occurred, the question

* The facial vein differs from other external veins in being less flaccid in its walls and more patent in its canal, and communicating at its lower dependent end with the jugular, and by its upper with the sinuses of the brain; thus affording unusual facilities for the escape of morbid material from its canal into the general circulation.

† *Gazette Hebdomadaire*, 1863, No. 47.

‡ *Med. Times and Gaz.* Sept. 1852.

§ *On the Occurrence of the Malignant Pustule in England*, by W. Budd, M.D. London, 1863.

|| *Pustule maligne et Œdème malin*, par J. Bourgeois, Paris, 1861.

of their being instances of malignant pustules was considered and negatived both by Mr. Ludlow and by others well qualified to form a sound and discriminating judgment.

That carbuncles form on the face and, running the ordinary course of that malady, produce no unusual constitutional disturbance is a matter of common observation ; but that carbuncles, differing in their early stages in no recognisable feature from the above, not infrequently prove fatal, is but too true.

Facial carbuncle generally commences in a small itchy pustule or vesicle upon one of the lips (the upper lip for the most part) ; this vesicle in a day or two after its rupture is followed by a firm œdematous swelling of the lip, also of the nose and cheek, producing a hideous deformity. A few pustules, or vesicles, generally soon show themselves about the red edge of the lip, and the swelling extends ; the surrounding induration being perhaps less defined than in carbuncle occurring elsewhere. The pain is most intense, and the colour of the surface generally passes through the shades of bright red, dusky red, and dark plum colour, until it is almost black, particularly about the mucous margins of the lips. Suppuration is slow to occur ; but if the patient live long enough pus will form and be discharged together with the disintegrated cellular tissue.

The constitutional symptoms early in the disease indicate great depression of the vital power, the pulse being generally frequent and feeble, the skin hot, and the tongue soon becoming dry.

When death occurs, it generally takes place from pyæmia, the purulent infection of the blood either originating in facial phlebitis, as evidenced by the swelling and induration in the course of the veins, and spreading upwards through the orbit to the cavernous sinus, where pus may be formed ; or it may be contaminating the general circulation through the facial and external jugular veins.

The following furnishes a characteristic example of the disease ; we are indebted to the kindness of Mr. Paget for its particulars. A young gentleman of moderately strong constitution, when in his usual health, noticed a small pimple on his upper lip ; it gave him no pain at first, but on the second day it enlarged, and became painful ; on the third day he kept his bed, with increasing pain and swelling, and some constitutional fever. He quickly became worse ; and on the fifth day the whole of the left half of the upper lip, and part of the adjoining cheek were occupied by a thick hard carbuncular swelling not very distinctly defined in extent. The skin over it was dusky brownish and purplish red, and the rest of the cheek was cedematous, dusky, and hot. He had severe burning pain in the part ; the pulse was 145, full, jarring, and rather hard ; the tongue was dry and brown down the centre ; skin hot and dry ; thirst extreme ; slight headache ; he had had no shivering or sickness, and his appetite was good. The carbuncle was split from the mucous edge of the lip ; there was considerable hæmorrhage, which recurred a short time afterwards so freely as to require pressure to restrain it. He was ordered plenty of wine with nourishing food and bark. After the incision, for the first day the swelling and pain much subsided, the face regained a more natural colour, and the patient passed a good night. On the seventh day, though the parts had lost some of their hardness, yet the general swelling had increased in extent, and pus began to be discharged in flakes from the wound. In his general condition the patient was not worse. On the eighth day the carbuncle had still further supplicated, the general œdema had extended over the eyelids, and there was marked protrusion of the eyeballs and chemosis of the conjunctiva. The pulse had fallen to 104, the skin and the tongue were moist. Next day, the ninth of the disease, the pulse fell to 84, the patient became torpid, and at length nearly unconscious. He ceased to care for his food, his urine passed involuntarily, he became restless, trying to get out of bed ; the eyes were still further protruded. A purge was given, the quantity of stimulus diminished, and a blister applied to the nape. Next day his general condition was rather improved, though the eyeballs

protruded more; a slough had separated from the lip, and pus issued sparingly from small holes in its surface; there was redness and swelling over the right temple. On the eleventh day, he partially recovered his consciousness and power of voluntary micturition, and seemed better generally. On the twelfth he was still better; a small abscess was opened over the nose; pustules appeared on the eyelids. The carbuncle was at this time discharging thick pus, was shrinking and softening; pulse 104, with good power; food and wine taken readily. Next day the improvement continued in all respects. On the fourteenth day he again became dull and heavy, his pulse rose to 148, his urine was retained, a swelling appeared on the parotid; meantime the carbuncle was healing, and the swelling of the face was diminishing. During the next two days he became worse; a pustular eruption appeared about his abdomen and thighs, and two abscesses on his forehead; and he sank on the sixteenth day; the carbuncle being nearly healed, the swelling on the face having almost disappeared, and the protrusion of the eyeballs having diminished in extent. During the last few days of his illness there had been noticed some fulness of the veins about the left eyelid, and a feeling of induration about the lower part of the facial veins.

The cause of death in this case, as in others of which we possess the histories, appears to have been pyæmia, as evidenced, in the case quoted, by the secondary abscesses which formed, and perhaps by the pustular eruption, which, occurring as it did coincidently with an aggravation in the constitutional symptoms, probably indicated a purulent infection of the blood.

From the local symptoms alone, we know of no circumstance that will enable us to determine with certainty in cases of facial carbuncle whether the disease will be of the benign form or otherwise. Early suppuration, moderate pain, and a distinctly limited area of inflammatory œdema, are favourable signs; while the opposite conditions portend, but by no means infallibly indicate, an unfavourable issue to the case. The constitutional symptoms are often the first warning of the serious nature of the disease, and they are generally from the very first of an asthenic type; yet it not infrequently happens that nothing to excite anxiety occurs either in the constitutional or local symptoms until the access of well-marked pyæmic rigors.

Treatment. In the treatment of facial carbuncle topical remedies seem to have even less effect upon the disease than when employed elsewhere; and incisions, if they exercise (as we believe they do) but little beneficial effect when used for carbuncle in other parts of the body, exercise still less when employed on the face. The indications for general treatment are best found in the constitution and condition of the patient; nutritious food and an abundant supply of stimulants being generally required. Mr. Paget has had good success from the employment of quinine in this disease in very large doses; sufficient, that is, to produce the characteristic symptoms of cinchonism.

MALIGNANT PUSTULE OR CHARBON.

The following description of this disease is chiefly taken from M. Bourgeois' work entitled *La Pustule maligne et Œdème malin* (Paris, 1861). For an exhaustive list of the various Continental authorities on this subject, we would refer the reader to an excellent pamphlet on the occurrence of malignant pustule in England, by Dr. William Budd, who has collected a number of interesting cases to establish the existence, and even to some degree the prevalence, of malignant pustule in our own country.

Certain herbivorous mammalia, namely, oxen, sheep, and goats; horses, donkeys, rabbits, hares, and it may be others, are liable to an internal disease, or type of disease, to which various names have been applied. As a class, these affections are termed "charbonneux" by the French. The particular disease, as it occurs in the ox and sheep, is termed in this country "the blood," "joint-murrian," "black quarter," or the "quarter evil." The French synonyms for the same are "quartier," "charbon," and "sang-de-rate"

in the case of sheep; while in the ox the disease is termed "le sang," or "maladie de sang." In Germany the same disease is termed "milzbrand."

Malignant pustule or charbon in man is derived from the poison generated by this disease in animals. The disease can be communicated to man by direct contact with the hair, the hoofs, the horns, the hide, the bones, the flesh, or the blood of the diseased animal; and in this way butchers, farriers, shepherds, and curriers usually acquire the disease: while straw or other litter, hurdles, splinters of wood, stones, articles of clothing, may act as media for the communication of the disease to man. Flies and other insects that have been in contact with the carcasses of diseased animals may also transmit the disease.* The use of the flesh and milk of diseased animals is a more doubtful medium of infection; indeed, so many are the instances of a negative kind, where flesh that has caused malignant pustule by simple contact has been taken as food with impunity, that M. Bourgeois hesitates to include this as a means of infection.

Similarly, it is doubtful if the disease can be communicated by contact from man to man, or from man back to animals; such experiments having been at present always followed by a negative result. Nor is it probable that the disease can be communicated to man in the way of infection; we mean simply by atmospheric influences, and without actual contact with the poison.

The disease almost always attacks some exposed part of the body, and is therefore most common on the face and hands. This is as one would expect, from the local origin of the malady.

For some time after its onset malignant pustule is a purely local affection, and during this stage it is within control; and if the proper treatment be adopted, it can almost certainly be arrested, and the constitutional effects of the malady be averted.

The following is the usual course of the disease: from one to three days after the application of the virus to the surface of the body, there appears on the part a small red spot like a flea-bite, which is sometimes preceded, and is always accompanied, by a smart itching. After twelve or fifteen hours, a small vesicle appears on this spot about the size of a pin's head, containing a little brownish-red or yellow serum, on the rupture of which the itching generally ceases, and the skin beneath is seen to be dry and of a yellowish-brown or black colour. This discoloured spot indicates the death of a thin layer of the true skin, which soon extends through its whole thickness.

In less than twenty-four hours a fresh crop of vesicles appears, distended with brownish-yellow serum; they are situated in an irregular circle around the eschar of the skin. At this time the eschar is depressed, dry, of a brownish-yellow or black colour, and but little painful on pressure. After twenty-four or forty-eight hours the parts beneath swell, harden, and form a solid lump, which is pretty well defined in extent, and can be raised with the finger from the surrounding tissues ("bouton"): this swelling is occasionally absent. The mortification now extends up to, and even beneath, the circle of vesicles. As these are destroyed by the extension of the mortification, fresh ones form on the parts around; while the skin about, which at first was pale, reddens and finally becomes of a livid red colour. As the swelling increases, cedema comes on in the surrounding integument, which is ill-defined in its borders, gradually fading away into the healthy tissue. This swelling is but little painful, the temperature is but slightly raised, and it gradually extends itself, while bullæ form over the dead tissue towards the centre of the swelling. The central slough enlarges, but not to any great extent or depth; it is now extremely hard, while the surrounding swelling and cedema may become enormous. A curious fact, says M. Bourgeois, is the little pain that these large swellings

* Instances of nearly all the above-mentioned modes of contagion are given in M. Bourgeois' work.

cause; and that when they become painful it may be looked upon as a hopeful sign that a reactionary process has commenced. If the disease be situated upon the trunk or extremities, inflamed and indurated lymphatics are often seen stretching away from the swelling to the neighbouring glands. Such is the usual course of a malignant pustule: at first a red spot, then a vesicle, then a solid and circumscribed swelling beneath ("tumeur charbonneuse") surrounded by a diffused and softish œdema, a dry leathery central eschar, and a secondary formation of vesicles or bullæ.

The more characteristic signs as distinguishing this disease from others may be stated to be a remarkable freedom from severe pain, the little increase in the temperature of the parts, the dryness of the slough, the *entire absence of pus* in all stages of the malady, and the fact that the destruction of the tissues proceeds from the skin towards the deeper tissue, and not, as in carbuncle, by a central sloughing of the subcutaneous parts, followed by death of the skin.

Malignant pustule generally runs its course either to a favourable or fatal issue in a period varying from four to nine days. One must not suppose, says M. Bourgeois, that all malignant pustules follow this succession of changes exactly as described above. In some cases the eschar is not larger than a lentil, and occupies but a part of the thickness of the integument, the surrounding œdema hardly exceeds the "tumeur charbonneuse" in extent; which latter may even not exist, and these differences are consistent with the most favourable or fatal issue. Still, for the most part, the more extensive the local affection, the more is there to be apprehended as regards the issue of the case.

Constitutional symptoms. These may early show themselves; often soon after the appearance of the first vesicle, the patient being seized with rigors, headache, and symptoms of general depression. At other times the symptoms come on a few days later, most commonly showing themselves between two and three days after the appearance of the circumscribed swelling ("bouton") at the base of the eschar; very soon the tongue becomes coated with a white fur; the pulse is full, frequent, and soft; the bowels constipated; and appetite is lost. These symptoms are generally followed by bilious vomiting, depression, faintings, difficulty of breathing, loss of sleep, a coldness of the external surface, a failure of the pulse, cold sweats, and the patient generally dies in a condition much resembling that of collapse from cholera; delirium is rare. Usually before death the local swelling ceases to increase; indeed, in some few cases, may recede, while the colour of its surface becomes more livid and it loses its temperature.

Post-mortem appearances. The decomposition of the body is very rapid. The serous cavities generally contain a small quantity of darkish serum; the blood is found fluid and dark-coloured; small ecchymoses are often found on the mucous membrane of the stomach and small intestines; the spleen is engorged with blood and softened; the liver and other parenchymatous viscera are more or less congested with dark-coloured blood.

The posterior lobes of the lungs are much loaded with blood, and the bronchial mucus is blood-stained.

The heart and brain show the same tendency to early softening and passive congestions; the local slough, if examined, is found to consist of dry stratified layers, dark brown or black in colour, like old leather in consistence, and creaking when cut with a knife.

Prognosis. Of the various circumstances influencing the prognosis, M. Bourgeois enumerates—1. the age; 2. the seat of the affection; 3. the constitution of the patient; and 4. the local character of the disease, and its duration before treatment is adopted. 1. The younger the patient, the better is the prospect of recovery; 2. the head and neck are the most dangerous seats of malignant pustule; 3. as in other diseases, the amount of constitutional resistance the patient can oppose to the malady largely influences his chance of recovery; 4. it is a highly favourable circumstance

if the patient is seen when the disease is still local, and before the symptoms of general blood-poisoning have shown themselves; and the prospect of recovery is less bright the longer the time that has elapsed since the onset of the malady, and the greater the severity of the constitutional symptoms. A favourable local sign is the existence of a bright-red flush over the part, and any considerable increase in the normal temperature; also the distinct limitation of the local induration may be looked upon as a circumstance of favourable augury.

Treatment. Since this malady in its first onset, and for an uncertain period afterwards, is merely a local affection, it is for a time within the control of local remedies; these being any of the more active forms of potential cautery and the hot iron. M. Bourgeois agrees with others in recommending, as the most efficient and easily-applied form of caustic, the solid hydrate of potash, which the former gentleman uses by rubbing the solid stick of potash into and around the eschar and its surrounding vesicles, until it is thoroughly destroyed and the healthy tissues are reached; the semi-fluid detritus is then to be wiped away, and the dead parts allowed to separate by ulceration.

In cases where the disease has made great progress before being subjected to treatment, and the tissues are penetrated to some depth, M. Bourgeois recommends that a layer from the surface of the eschar be raised and removed with a knife, and the potash be then applied. In any case where the local slough extends after the application of the caustic, the latter must be re-applied as soon as the non-arrest of the local disease becomes evident.

The constitutional remedies in this disease are such as the general symptoms of the case would suggest, the indication being to avoid all measures likely to exhaust the patient, and to administer stimulants and nourishing food in an easily assimilable form.

Occasionally malignant pustule assumes another external appearance, to which M. Bourgeois gives the name of malignant oedema.* It differs from malignant pustule only in its external manifestation; in all more essential features the diseases are identical. It is generally met with about the eyelids and face. The prominent feature of this form of the disease is a softish, ill-defined, indolent-looking oedema of a pallid colour, rapidly increasing; the subsequent formation of vesicles is less regular, and the appearance of a characteristic central eschar may be absent, as also may be the central induration.

CHILBLAIN.

This term is applied to certain characteristic local inflammations of the integument of an asthenic type, subject to regularly recurring attacks of congestion. They appear in persons predisposed to the affection under circumstances of sudden variations in the external temperature.

A predisposition to this affection often prevails in certain families; it exists most frequently in the young of both sexes, and in adult females more often than in men. This liability to chilblains generally passes off as manhood comes on, and is but rarely met with in men over forty years of age, though in women it may continue throughout life.

The predisposition to chilblains is often connected with a certain slowness or feebleness of the general circulation, as evidenced by cold feet and hands, and occasional lividity of the finger-ends and lips during winter-time. Their appearance is generally ascribed, and often with truth, to the too sudden warming of a part when thoroughly chilled down by previous exposure to cold. But a change of weather, or of residence to a colder neighbourhood, a sudden thaw after snow or prolonged frost, or the appearance of an east wind, is sufficient to occasion them in many persons. In some individuals, if the hands or feet are chilled down, from any cause, below a certain

* Bourgeois, p. 105.

standard, notwithstanding all precautions to the contrary, it is impossible to restore the temperature without producing one or more chilblains.

There are three kinds, or rather degrees, of chilblains: 1st, where there is simple congestion, generally attended by great itching, alternating with periods of extreme tenderness to external pressure; 2d, where vesication occurs; and 3d, where death of the subjacent skin or areolar tissue takes place.

The same chilblain may pass through all these phases in the above-named order; but more frequently we find that in the same individual chilblains run a pretty constant course. In some they do not vesicate or break; in others they vesicate easily, and on breaking show superficial excoriations; in others, after breaking, the subjacent integument is found ulcerated or more completely devitalised. Again, some persons suffer from chilblains which itch but little, but show themselves as red and intensely sensitive swellings of the integuments. From the appearance of a chilblain in its early stage but little information is to be gained as to its eventual result. Most persons, however, know too well what course their own chilblains will pursue from repeated experience.

The local symptoms and appearance of chilblains are too familiar to require a special description, and we therefore pass them by to allude to a peculiarity belonging to this affection, which, we believe, has not previously attracted notice. The peculiarity to which we wish to draw attention is the regular and periodical exacerbations that occur in the local symptoms so long as the chilblain is in progress.

Almost all chilblains are subject to a diurnal attack of congestion, which occurs during the afternoon or towards evening, when the affected part, by a feeling of increased heat and a pricking sensation, shows signs of an increased afflux of blood; this is soon followed by intense itching, then by swelling, with relief to the irritation; and lastly succeeds a condition of soreness, aching, and extreme sensibility to pressure, which continues throughout the night, and is peculiarly appreciable next morning, when the sufferer puts on his shoes or boots.

The exact hour of the daily attack of congestion, as well as its severity, may within certain limits be influenced by external circumstances. Thus the attack may be hastened by any thing which stimulates either the local or general circulation of the body, such as the exposure of the parts affected to the warmth of a fire or a heated room. The constitutional effect of the mid-day meal in children, and the evening dinner in adults, is generally sufficient to determine the period of attack; children for the most part suffering in the afternoon, adults in the evening, during or after dinner; conversely the opposite effects may be observed where external circumstances are unfavourable to the advent of the attack, which latter may be postponed until after the sufferer has retired to rest. In many young persons at boarding-schools the extremities are cold throughout the day; and it is not until the child is in bed that the general temperature is restored to its natural standard. The severity of each daily exacerbation generally bears a direct relation to the degree of cold to which the patient has been previously exposed; and the colder the chilblains are in the morning, the more will they itch in the afternoon.

We have occasionally met with persons whose chilblains are subject to two attacks of congestion daily: the first occurring late in the afternoon; the second at night-time, when the parts are warm in bed. In some few persons chilblains do not itch at all—they tingle and burn during the daily attack, and at other times are swollen and extremely tender.

During the onset of the diurnal exacerbation the general circulation is quickened, and the temperature of the affected part is considerably raised, being often ten degrees or more above that of the part before the attack set in, and from one to six degrees above the neighbouring surface of the healthy skin.

Chilblains generally appear on those parts of the body where the circula-

tion is most liable to be affected by changes in the external temperature. In the same individuals, however, the part of the body attacked every winter is little liable to vary. Some suffer on the hands alone; others on the feet only; while others may be attacked on both hands and feet; or, again, the lobes of the ears may be the seat of chilblain, or even the end of the nose.

Of the local causes of this affection those are most efficient that hinder the free circulation in a part, and thereby allow external cold to exercise its most depressing effects; such are tight gloves, elastic bracelets and garters, tight shoes, sitting long in cold rooms with the feet pendant, and other circumstances of a like kind.

Treatment. Though in some persons no precautionary measures will prevent the occurrence of chilblains, nor will any remedy remove them, yet even in these individuals both their number and their severity may be favourably influenced by appropriate treatment; while in other persons the attack may be either altogether avoided, or if it occur, the chilblains may be cured.

Of general measures either to prevent or mitigate the severity of an attack, the most efficacious are such as promote a vigorous state of the general circulation. In matters of diet, the addition of a glass or two of wine to the daily food, or a morning draught of warm milk with rum will often prove of service; while if medicine be required, small stimulant doses of opium with quinine may be advantageously given. In persons liable to chilblains, and especially in young people, additional under-clothing should be worn during cold weather; and, if possible, an even temperature should be maintained within doors by fires in the sleeping-rooms—for among time-honoured conventionalities none, in the case of young persons, is more conducive to chilblains than the great inequality that generally exists between the temperature of the sleeping and sitting rooms during winter-time.

The circulation and temperature in the extremities are best maintained by warm and particularly by roomy coverings for both feet and hands. For the hands, loose gloves lined with chamois-leather are best; and for the feet, large boots or shoes, and wash-leather or woollen socks. Tight gloves and shoes, tightly-laced boots, and garters, and elastic bracelets, should be particularly avoided.

As long as chilblains remain unbroken, and if the external surface is not too sensitive to pressure, various stimulating embrocations may be beneficially employed: such as Wardrop's liniment; a mixture of two parts of tincture of cantharides with six of soap-liniment; camphorated spirit; equal parts of turpentine and copaiba; or tincture of iodine and soap-liniment. When the external surface is very tender, a good local application is formed by a mixture of two ounces of collodion, six drachms of Venice turpentine, and three drachms of castor-oil; or tender chilblains, that do not itch, may be covered over by adhesive plaster spread upon kid or chamois leather.

To relieve the itching, if it be excessive and unbearable, some resort to the expedient of rubbing the part with snow, or plunging the feet into cold water; while others find relief by putting the parts into hot water with a small quantity of mustard-flour in it.

It may happen that the daily attack of irritation occurs at some hour of the day most inconvenient to the sufferer; perhaps interfering with his enjoyment when in society, or altogether deterring him from both business and pleasure during a certain period of the afternoon or evening. In such cases much discomfort may be avoided by artificially inducing the daily attack at an earlier and more convenient hour, and this may be done by keeping the feet for a short time in mustard and warm water. Vesicated chilblains may be protected by a coating of collodion and castor-oil varnish. For ulcers or sloughs resulting from chilblains, poultices smeared with turpentine, or resin cerate, or Peruvian balsam, may be applied until the slough separates, when the sore may be dressed with any of the above-named applications upon lint.

DISEASES OF THE NAILS.

Onychia maligna is a term applied to a specific form of ulceration commencing about the matrix of the finger-nails. The disease is almost confined to children under ten years of age, and is by no means of frequent occurrence. Among more than seven thousand surgical out-patients under twelve years of age, I have found the disease in nine instances only, and these cases occurred between the ages of one year and seven.

Onychia usually has its origin in a pinch or a crush of the finger-end, such may either bruise the matrix or loosen the attachments of the nail. Soon after the injury, the finger-ends swell, and fluid is effused beneath the nail; which latter loses its natural colour, and becomes thin and flattened at the tip, or more rarely curled up laterally. As it grows, it turns upwards from its normal attachment, and exposes beneath it an exceedingly foul and painful ulcer, having a peculiar and characteristic fœtor; while the finger-end becomes greatly enlarged and bulbous-looking, its integuments being hardened, inflamed, and of a livid red colour.

The disease seems little prone to spontaneous recovery; but may continue to progress until the last joint of the finger be lost, or the phalanx necrosed by extension of the ulceration.

The treatment consists, first, in the evulsion of the nail, if it be loose, displaced, or discoloured; subsequently the ulcerated surface may be dressed with black wash, or a lotion formed of one or two drachms of the liquor *passæ arsenitis* to an ounce of water. The arsenical application appears to exercise some specific effect on *onychia*, and rarely fails. Such constitutional remedies as seem suitable to each case may at the same time be employed; among these chlorate of potash, with bark, appears to be of use in many cases. Amputation has been occasionally practised as a cure for this disease, but a mercurial course has been recommended. The former is an unnecessary mutilation, and the latter is not required in the form of the disease described above.

There is a form of *onychia* having its origin in constitutional syphilis. It usually attacks the toe-nails, and is often associated with ulcerative fissures between the toes; 'rhagades digitorum,' as they were formerly termed. In this form of the disease the ulceration is generally less extensive, the surrounding swelling is not so considerable, and the nail is less seriously implicated; while the history of the patient, or the concurrence of some other symptom of syphilis, furnish evidence of the nature of the disease. Syphilitic *onychia* may be treated locally by the black or yellow wash; it being, of course, of primary importance to adopt appropriate anti-syphilitic measures.

Psoriasis may attack the nails, either those of the fingers or toes; and it is often, though not always, local evidence of constitutional syphilis. In this affection the central part of the nail becomes thickened, rough, and scabrous, and unnaturally convex; the free edge is often split; the cuticular fringe at the bottom of the nail is ragged and retracted, leaving a deep fissure between the nail and the skin of the finger. The whole nail, in an extreme case, resembles in miniature the outside of the concave shell of an oyster. The affection is chronic in its nature, and exceedingly difficult to cure.

In syphilitic *psoriasis* the administration of small doses of mercury continued over a long period is likely to prove beneficial; and in cases of non-syphilitic origin the most hopeful constitutional treatment is that by arsenic in combination with some tonic. The appearance of the nails may be much improved by smoothing them down with glass or fine sand-paper; or the thickness may for a time be removed by friction with dilute acetic acid; and at night-time the skin at the margins of the nails may be dressed with a mixture of white precipitate and tar-ointment.

In-grown toe-nail, as the affection is usually termed, occurs, we believe,

invariably on the outer side of the nail of the great toe. It is caused either by over-crowding the toes and thereby thrusting the soft parts over the margin of the nail, or by the toe-nail being cut away too deeply at the outer angle, allowing the soft parts to encroach on the proper limits of the nail; which latter, so soon as it again grows up from below, imbeds itself in the overlapping integument. The continued pressure causes considerable pain and inconvenience in walking, and if unrelieved often gives rise to a fungous growth of very sensitive granulations, which may cover the entire nail.

In the treatment of this affection it is of primary importance to secure a roomy covering for the foot. If the disease has been but a short time in progress, and has not produced any considerable mass of overhanging integument or fungous granulations, the pressure of the nail on the soft parts may be relieved by carefully packing into the cleft or groove on the affected side of the nail oiled cotton-wool in small shreds with the flat end of a probe or the edge of a pen-knife. This may be effected without causing any pain. The quantity of wool introduced may be gradually increased at each application, until the soft parts are raised and pushed aside, so as to expose the free edge of the nail, beneath which the wool should be inserted until the natural state of the parts is restored; when the nail should be allowed to grow up, so as to form a right angle at the outer corner. If there is much inflammation of the parts, the toe may be kept wrapped in water-dressing during the above described treatment; while the overhanging integument may be assisted to regain its natural relation to the nail by a strip of adhesive plaster applied to it, and drawn round beneath the toe, so as to exercise some traction on the part.

Another method of relieving the flesh from pressure in more severe cases is by scraping the in-grown side of the nail very thin with glass or the edge of a knife; or the free edge of the nail may be notched, and a longitudinal division be made down to the matrix, by cutting with a knife from the surface. This will allow the partially detached strip, as it grows, gradually to overlap the body of the nail, and thus free the soft parts from pressure.

When, from neglect of remedial measures, the nail has penetrated deeply into the flesh, and there is either considerable ulceration or fungous granulations, the most successful treatment is to remove at once the offending portion of the nail. This may be done rapidly, but painfully, by thrusting a strong pair of scissors beneath the nail, from its free edge down to the matrix, and tearing out the outer strip of nail with strong forceps. The same proceeding can be effected more gradually and less painfully by those skilled in the practice, by effecting the division of the nail with a knife from the surface towards the matrix, and then slowly separating the semidetached portion from its deep connexions.

The exuberant granulations which often form in this disease can be disposed of by dusting with the oxide of zinc, or by a lotion formed of the tincture of the sesquichloride of iron, or they may be destroyed with sulphate of copper or lunar caustic. Removal of the overhanging mass with a knife though effectual, somewhat prolongs the healing. It has been recommended to treat this affection by the introduction of a thin strip of sheet-lead beneath the margin of the nail. The lead should be bent so as to pass round beneath the toe towards the inner side of the foot. This plan is somewhat difficult to carry out, on account of the pain it is liable to occasion.

THOMAS SMITH.

APPENDIX.

SURGICAL DISEASES OF CHILDHOOD.

THE surgery of the diseases of childhood naturally divides itself into three different classes, viz. the pathology and treatment of, 1. Malformations ; 2. Injuries and their sequelæ ; 3. Diseases. The purport of this essay is not to give a complete account of each of these subjects, inasmuch as many of their topics have been treated elsewhere ; but to indicate the matters with which the surgery of childhood is principally concerned ; to point out to the reader whereabouts in this work such of those matters as have been included in previous essays may be found ; and to give a short account of those which have not been elsewhere treated.*

It is a very well-known fact that children will sometimes bear severe accidents or surgical operations without any injury to their general health ; while at other times much slighter injuries or operations are followed by very alarming symptoms, and sometimes even by death, although the child does not seem unhealthy, and is not much reduced by disease ; so that children are sometimes said to bear operations better than adults, and sometimes the reverse. It is not always easy to explain this discrepancy ; but the main principle to be borne in mind in operations on children seems to be this—that children bear the loss of blood, and all other causes of sudden shock, worse than adults ; but bear protracted suppuration and long confinement to bed better, and are far less liable to the secondary complications of wounds. Erysipelas in its milder form is not very rare in children's hospitals, where the spreading or ulcerative variety of phagedæna may also be occasionally seen ; and the condition usually known as diffuse phlebitis is also met with, though more rarely ; but pyæmia, though not unknown, is exceedingly rare ; and diffuse cellular inflammation (or phlegmonous erysipelas) is almost, if not quite, unknown.

* The following list comprises most of the topics in the foregoing pages which relate exclusively to diseases peculiar to, or more usually met with, in childhood : Noma, or cancerum oris, vol. i. p. 177 ; Trismus nascentium, p. 304 ; Scrofula, p. 336 et sqq. ; Congenital cutaneous cysts, p. 472 ; Vascular tumours, p. 497 ; Burns and scalds, p. 723 et sqq. ; Separation of epiphyses, p. 759 ; Incomplete fractures, p. 761 ; Depressions of the skull, vol. ii. p. 115 ; Foreign bodies in the ear and nose, pp. 254-256 ; Burn and scald of the larynx, pp. 288, 289 ; Foreign bodies in the air-passages, p. 294 et sqq. ; Laryngotomy and tracheotomy, p. 310 ; Rupture of the thoracic viscera, without wound, p. 385 ; Rupture of the urethra, p. 490 ; Dislocation of the head of the radius, p. 582 ; Means of strangulation of hæmi, vol. iii. p. 46 ; Harelip, p. 121 ; Contracted cicatrices, p. 130 ; Supernumerary auricles, p. 135 ; Strumous glands, p. 271 ; Orthopaedic surgery, p. 557 et sqq. ; Diffuse periostitis, p. 623 ; Scrofulous disease of bone, p. 655 ; Scrofulous disease of joints, pp. 717, 741 ; Hip-joint disease, p. 778 ; Excision of the hip, p. 813 ; Spinal disease, p. 831 ; Gumboil, vol. iv. p. 3 ; Congenital hypertrophy of gums, p. 18 ; Exanthematous jaw-necrosis, p. 50 ; Diphtheria and croup, p. 60 et sqq. ; Enlarged tonsils, p. 81 ; Cleft palate, p. 88 ; Nævus of lips and cheeks, p. 108 ; Congenital cysts of the mouth, p. 114 ; Tongue-tie, p. 118 ; Congenital malformation of intestines, p. 154 ; Intussusception, p. 161 ; Prolapsus of rectum, p. 194 ; Polypus of rectum, p. 221 ; Congenital hernia, pp. 234, 292 et sqq. ; Extroversion of bladder, p. 339 ; Incontinence of urine in children, p. 359 ; Hypospadias and epispadias, p. 382 ; Stone, p. 424 et sqq. ; Congenital malformations of vagina, p. 492 ; Imperfect development and retention of testis, p. 540 et sqq. ; Congenital hydrocele, p. 550. Besides these, all affections of the eye, the ear, the skin and its appendages, will be found in the essays devoted to those subjects.

Our first care in operations on children must be to avoid shock. Hæmorrhage is the chief cause of shock, where anæsthetics are used; but when this is not the case, pain, terror, and struggling are also most efficient causes of prostration, and more especially in protracted operations. Even when chloroform is used, a very protracted operation is liable to be followed by prostration—both because long operations generally involve the loss of much blood, and because the prolonged administration of chloroform is itself a very serious cause of depression. I have had no experience of the effect of ether when administered for a long time; but there seems every reason to believe that it would prove equally depressing. But operations in children are often made longer by the necessity which there is for examining the parts under chloroform at the time of the operation, since the child will not permit this to be done without the anæsthetic. In all cases, however, in which it is possible, this examination should be performed a few days previously; and the Surgeon should come prepared to begin the operation at once. If the proceeding is of such a nature that the child must necessarily be kept for a long while under the influence of the anæsthetic, it seems a good plan to administer a stimulant a little while before, such as a glass of wine or a little sal-volatile.

But even without much bleeding or prolonged suffering, there are some cases of operations in children in which the shock proves fatal without any obvious cause. This is no more than what happens—though more rarely—to very sensitive adults; but it is, perhaps, more frequent in children. Thus, in a case of lithotomy under my care, the bladder was reached without difficulty or hæmorrhage; only a slight delay occurred in seizing the stone, on account of its smallness and smoothness; the child was on the table altogether only a few minutes. No bleeding occurred afterwards, except the slight oozing which frequently follows the flow of urine over the surface of the wound. Still, the boy never rallied, and died next day. There was no lesion discoverable on post-mortem examination. Stimulants were given in this case; but perhaps not so freely or so frequently as they should have been. If such a case were to occur again, it would be well to make the child take small quantities of wine and of diffusible stimulants every hour, until a decided change for the better resulted. Of the serious effects which may follow upon the shock, pain, and struggling of an operation, even when there is no hæmorrhage, the following example lately occurred to me. A twin child, a few weeks old, was brought to me for advice as to a congenital tumour of the orbit, which had pushed out and ruptured the globe of the eye. In consequence of the rapid growth of the swelling, life could not be long maintained unless the disease were removed; yet the child was so exceedingly puny, emaciated, and feeble, that it was obvious the least injury might prove fatal, much more so serious a proceeding as removing a tumour which filled the whole orbit, and projected a good deal on to the face. Having placed the risks of the operation fairly before the mother, I proceeded to remove the tumour without administering chloroform. Perhaps this was not the best course which could have been pursued. Very possibly the careful administration of a small quantity of the anæsthetic, sufficient to dull the sense of pain without producing more profound anæsthesia, might have saved the child from the consequences which did ensue. The operation was finished without much blood having been lost; but then the child passed into an alarming state of syncope. Restoratives were at hand; and when by stimulation with ammonia, wet sponges dashed on to the face and throat, and artificial respiration, the powers of swallowing had been regained, a little wine and brandy could be given, and the child seemed restored to life. But she soon relapsed, and appeared again to be dead; in fact, was pronounced dead by some of those who were standing about. Artificial respiration revived her for the time; then the galvanic battery was brought into play, and applied to the chest with marked benefit; stimulants being also constantly administered. But for three-quarters of an hour the

child's life was in the most extreme danger; and as soon as the galvanism was suspended, syncope recurred. At the end of that period, she recovered permanently from this alarming condition.

This mention of the grave symptoms which may follow upon the pain and shock of an operation naturally introduces the consideration of the administration of anæsthetics in childhood. No department of surgery has profited more by the discovery of anæsthetics than that which is concerned with children's diseases. It is very frequently quite impossible to examine a diseased joint satisfactorily and thoroughly, to sound for stone, or to perform any other examination which either lasts long and produces pain, or which requires quiet and silence, without rendering the child unconscious. Hence the administration of ether and chloroform is of daily occurrence in our children's hospitals; and the very great rarity of accidents from such administration shows that in all essential particulars chloroform (which is the anæsthetic usually employed) is as safe as it is certainly efficient. But chloroform often causes unpleasant, and sometimes even alarming, symptoms; and although I have not yet had the misfortune to witness a fatal result, I saw one case in which the patient was only revived by a vigorous application of restorative measures from a condition of apparent death. The unpleasant symptoms referred to are chiefly the rapid fluctuations of pulse, and the tendency to sudden congestion and stertor. If these threatening symptoms are overlooked, and chloroform still given, the pulse and respiration may be suddenly suspended, and alarming or even fatal symptoms ensue. So that it is always necessary to watch the pulse closely, and to give chloroform with great caution in children, even when they breathe it quietly; and still more when, from their struggling and crying, the anæsthetic is taken in irregular and often very full doses. Usually after such struggles the child passes almost at once into an insensible condition; and, as soon as this occurs, the chloroform should be administered only to such an extent as to prevent struggling. Both children and grown people when under chloroform will give indications of pain, while the real feeling of pain (at least if tested by the patient's remembrance of the operation) is quite absent. It is therefore not necessary for the comfort of the patient that every movement and every sound indicative of pain should be suppressed.

When asphyxia comes on, prompt measures will almost always save the patient. The tongue should be at once pulled as far as possible out of the mouth with a pair of forceps, and artificial respiration should be resorted to. Whatever difference of opinion may exist as to the most effectual method of performing artificial respiration in other cases, I should think that a very little experience would convince any one that in those at least of asphyxia from chloroform in childhood, the most natural and simple method is also the best, viz. by manipulation of the ribs. The small size and yielding material of the chest-walls in childhood enables us to manipulate the lungs through them almost as easily as if they were uncovered. Dr. Marshall Hall's method (if it is ever more effectual than manipulation) is certainly inapplicable in these cases, since it endangers the flow of substances from the stomach into the larynx, and interferes with other restorative measures which may do good, but which cannot be allowed to supersede artificial respiration.

It does not appear that there are any limitations to the use of anæsthetics in childhood. I have administered them at the earliest periods of life, and believe that, with proper care, operations are safer with them than without them, even in the most exhausted and puny infants. In harelip and other operations about the mouth I rarely administer chloroform, although I have no strong objection to doing so; but in all other painful proceedings the general rule should be to give them. One motive, however, for the use of anæsthetics is absent in children, since they have little apprehension of the operation, and thus do not suffer from those agonies of anticipation which are often the worst part of a surgical operation to an adult.

As soon as the child has recovered consciousness, the smarting of the

wound, and the remembrance of his fright, makes him cry violently; and then, unless vomiting seems probable, it is well to give a few drops of laudanum, proportioning the dose to the child's age. But in other cases the operation is succeeded by a quiet sleep. Vomiting, which is very common with children, even if they have had no food for some time, usually subsides before consciousness is completely restored, and is very seldom troublesome.

Serious operations in children are almost always followed by smart fever. This is, however, usually transitory, and subsides with the commencement of suppuration, and it may be much diminished by irrigating the wound with water dropped out of a bottle by means of a lamp-wick, or the application of ice, as recommended by Professor Esmarch. The greater probability of union by first intention in children makes it justifiable to close the wounds more accurately than is usually advisable in adults; but any dressing which is likely to prove painful, whether in application, in use, or in removal, ought to be avoided as much as possible.

MALFORMATIONS.

TABLE OF MALFORMATIONS.

- I. Of the whole body, or general. Double monsters; attached foetal remains.
- II. Of the head and face.
 1. Of the mouth: congenital fissure; harelip; fissured palate.*
congenital closure or atresia oris;
microstoma congenitum.
 2. Of the nose: congenital absence.
 3. Of the eye: † " fissure.
 " defects of iris.
 " cataract.
 " closure of the lids.
 4. Of the head: ‡ cephalæmatoma, congenital tumours;
 meningo- and encephalo-cele.
- Of the spine. Spina bifida; congenital tumours.
- III. Of the neck. Congenital closure of œsophagus; congenital stricture.§
- IV. Of the thorax. " fissure of the bones; malformation of heart.§
- V. Of the abdomen, &c. Congenital defect of parietes; § malformation of viscera; § imperforate rectum; congenital hernia; || undescended and retained testis. ¶
 Congenital adhesion and imperforation of vagina.**
 Hypo- and epi-spadias; extroversion of the bladder. ††
 Hermaphroditism. Congenital defects of the pelvis. §
- VI. Of the limbs. Deficiency of bones and limbs; § supernumerary fingers and toes; webbed fingers and toes; congenital dislocations; fracture and amputation in utero.

Attached Fœtus.

In very rare instances twins become attached in the womb, and are born thus into the world; and this in two different conditions, viz. either as two living individuals united at some part of their bodies; or one fœtus is only

* Treated of above, see vol. iii. p. 121, vol. iv. p. 88.

† Treated of in the essay on DISEASES OF THE EYE, vol. iii.

‡ Treated of in the essay on REGIONAL SURGERY.

§ Nothing is said about these malformations here, since they do not admit of surgical treatment.

|| See the essay on HERNIA, pp. 239, 292.

¶ See the essay on DISEASES OF THE MALE ORGANS, p. 540.

** See the essay on DISEASES OF WOMEN, p. 492.

†† See the essay on DISEASES OF THE URINARY ORGANS, pp. 339, 382.

imperfectly developed, and in this imperfect condition is attached to the other as a parasite.

Of the first condition the Siamese twins and the Hungarian sisters are the best-known examples. The only purely surgical question which occurs with reference to the treatment of such cases of monstrosity is as to the expediency of dividing the connecting ligament, and setting them free from what is not merely a restraint but also a grave danger, since the death of one twin must necessarily involve that of the other. In a work like the present it would be absurd to waste space upon such curiosities of surgical practice, in the treatment of which the Surgeon would be bound to have recourse to the authorities specially devoted to the subject.* It may, however, be stated in general terms that when important parts (such as the anus) are common to the twins, the operation is impossible; that when the connexion is in or near the buttock, a communication may fairly be supposed to exist between the spinal columns, which would render any operation fatal; but that when the connexion is sideways, and the band of moderate thickness and extent, the operation ought to be attempted, and has been performed with success;† also that if one twin die before the other, an attempt might be made to cut the dead one away.

The second class of joined twins—viz. that in which one of the twins is only slightly developed, and included in the living twin as a parasitic growth—is of considerably more importance in surgery than the former, since both the diagnosis and the treatment become occasionally matters of considerable doubt and difficulty. I shall consider these cases under the natural division of attached parasites and included parasites; but we must not forget that this division, however natural, is not to be trusted in practice, since a great part of the attached parasite may be included. However, the difference is so striking between those cases in which large parts of the parasitic fœtus (usually terminating in more or less rudimentary extremities) hang pendulous from the principal organism, and those in which the parasitic remains form a mere tumour which may not even be prominent under the skin, that the distinction will always be made.

No difficulty of diagnosis can exist in the case of the attached parasite. The advantages and the feasibility of removing it from the body to which it is appended will depend in a great measure upon the place and extent of its attachment, and partly upon the nature of the parasite itself. If a large part of the imperfect twin is attached in the near neighbourhood of vital organs, as in the case of the Asiatic, whose cast is in so many museums, having a large part of the body and both extremities of another fœtus hanging from his thorax, much care would be required in attempting the removal of the parasitic growth. Still there would, I should suppose, be no insuperable difficulty in amputating at any rate so much of it as would restore the person to a natural appearance when clothed. A clamp might be fixed tightly on the neck of the tumour, or large vessels might be discovered and tied before the operation, or the pedicle might be severed by gradual strokes of the knife

* Amongst which may be specially mentioned Dr. W. Braune's work entitled *Die Doppelbildungen und angeborenen Geschwülste des Kreugbeingegegend*, where all the cases of twins attached in the sacral region are given.

† The case in which adhering twins were successfully separated is related by König in the *Ephem. Germanicæ* (nat. cur.), 1690, vol. viii. dec. ii. obs. 145.

A drawing is given of them united by a band, which is described as stretching from the ensiform cartilage to the umbilicus, and as being an inch broad, one and a half inches deep, and five inches long. The umbilical cord was single, and contained four arteries and two veins. Its lower part was attached to the band, and it seems doubtful whether the band was really any thing more than a fusion of the two cords. A ligature was put upon it first, and then it was divided with a knife. The separation, he says, was effected "ligaturâ prægressâ indies strictiori, dein cultelli scissurâ."

and the vessels tied as they were divided, or finally the question of piecemeal amputation at several sittings might be entertained.*

The removal of such parasites when they occupy (as they far more often do) the pelvic region is very necessary to the patient's comfort; but here, before their removal is decided on, the question of their nature and connexions must be very carefully considered. In those cases of double monsters (like the Hungarian sisters) where the twins are attached by a broad band near the buttocks, it has always been found that either the rectum, genitals, or lower end of the spinal column, or all these parts, were common to both bodies; and therefore that the twins could not be separated without fatal consequences. But when the deformity is that which is commonly called "the human tripod," in which the two legs of another foetus, blended together into one, are attached to the pelvis, no such connexion is probable. The genitals of the parasitic foetus as well as the spinal column are probably absent; and if they were developed, it would still be possible in many cases to remove the projecting extremities. In cases of tripodism, therefore, amputation should be practised, especially on males, in whom the defect could only be concealed from view by condemning them to wear female clothing. All the published cases of this deformity will be found collected in the work of Braune, *Die Doppelbildungen*, &c. I would especially call attention to the case (mentioned on p. 20) of Anna M. Przesomyl, a Bohemian. She was shown, at six years of age, to the *Gesellsch. d. Naturforscher* in Prague, and had then an irregular oval swelling, covered by the normal skin, hanging from the buttock by a pedicle, so that it struck against the legs when she walked. The skin was healthy, except over the pedicle, where it was thin, and almost like mucous membrane. Bodies resembling long bones could be felt in the tumour, and there were "evident traces" of fingers or toes projecting from its lower part. Foetus in foetu was universally diagnosed. As no evidence could be obtained of the extent of the tumour inside, or of the nature of the connexion with the pelvic organ or spine, the operation was declined. The child was then taken about as a show, and seen by all the anatomists and surgeons of Germany, Holland, Sweden, and Denmark. Dieffenbach wanted to remove the parasitic growth; but the father would not consent on account of the gain which he made by showing the child. The parasite grew; but her health continued quite good. At sixteen she determined to have it removed (although she could walk quite upright, and had perfect health), so much did she suffer from the weight of the parasite. For its shape, size, &c. see the engraving in Braune's work. The length was about 26 inches; the weight was guessed at about 20 pounds; the pedicle, which passed into a kind of niche in the buttock, was about as thick as the forearm.†

* Since the above was written, I have been informed by Dr. Pancoast jun., of Philadelphia, of a case in which his father has successfully removed with the écraseur an attached parasite from the facial region. The photographs of the child before and after operation are in the Museum of St. Bartholomew's Hospital. This operation seems to have been done in early infancy; and it would probably be in most cases advisable to make the attempt as soon as possible. More than ordinary complications in the operation, or unusual weakness of the infant, might induce the Surgeon to wait for a time. The photographs referred to show that the parasitic foetus was attached to one cheek of the living child, that the body was provided with rudimentary extremities, and ended in a large fibro-fatty mass; and that on cutting it open many of the parts of the natural body could be distinctly traced in it, especially the gastro-intestinal tract. The only harm that was occasioned by its removal appears to have been that a fistula into the mouth of the infant was left in consequence of the buccinator muscle having been prolonged into the coverings of the parasitic foetus, and having been injured in its removal. It is very much to be wished that further particulars of this remarkable case should be published.

† *Prag. Vierteljahrschrift*, 1850, vol. xxv. p. 74.

It was successfully amputated through its first swollen portion, leaving a considerable stump; but this stump, which would never heal, was accidentally attacked with gangrene in consequence of a fall, and was then successfully removed by ligature and sawing through its bony connexions. In the end the girl seems to have been quite cured.

I need not dwell here on the cases of included parasites (*i. e.* foetal remains forming a tumour, either subcutaneous or in one of the great cavities or viscera), since such cases must be treated on the same rules as any other innocent tumour. It is, in fact, only when the parasite is near the surface, and lies in a situation in which such growths are often met with, as the sacral or coccygeal region, that the nature of the affection can be even suspected before operation. The general rule of surgery must be borne in mind, that when a tumour threatens life, it is justifiable to run any risk for its removal; but that in operations of complaisance, as those are termed which are performed on account of affections not incompatible with bodily health, no danger ought to be incurred, except at the express wish of the patient, or his friends, if a child, after the nature of the case has been properly explained.

Congenital sacral tumours. In connexion with these cases of included foetus and attached foetus we must also speak of those rare cases in which congenital tumours are found in the sacral region, which have no distinct marks of parasitic origin. Such are the cystic, fibroid, and fatty congenital tumours.

These tumours it is important on many grounds to distinguish from the included and attached parasites. They are divided by Braune into three categories: 1. coccygeal tumours, which are compound cystic, and other congenital and more or less solid tumours of this region; 2. simple cysts; 3. caudal excrescences and lipomata. The first class are of various composition, and grow more or less rapidly. They are intimately connected to the sacrum and to the coccyx, when that bone is developed; and they very frequently are in connexion with the spinal membranes. When the spinal canal, however, is closed, they usually spring from the interior of the pelvis, and press the coccyx backwards. The anus is displaced forwards, and the growth is, according to Braune, always limited by the edge of the gluteus maximus muscle. Operative interference with such tumours is in the highest degree dangerous, and should by all means be avoided if possible,* though the occurrence of convulsions or other symptoms dangerous to life may induce the Surgeon in rare instances to interfere. Such was the case in the only tumour of this kind which I have myself seen. It was in appearance a simple fatty tumour, but was connected with the interior of the spinal canal, and had caused convulsions. It was extirpated with success by Mr. Athol Johnson, whom I assisted in the operation. We both saw distinctly the bulging and pulsation of the spinal membranes after the removal of the tumour. The child died of another disease some months afterwards; and the nature of the tumour was proved by dissection.†

The other descriptions of congenital sacral tumour, viz. the cystic and the caudal or lipomatous, are apparently somewhat less dangerous, especially the former, although none of these tumours can be operated on without risk.

The main points in the consideration of these rare affections are to distinguish if possible between the congenital tumour and the parasite, and to determine in the case of either of them whether there is any connexion with the interior of the spinal canal or with the pelvic viscera. The distinction between the parasites which do not show characteristic shapes (as those do, for instance, which terminate in fingers and toes) and the tumours is by no means easy.

* Braune gives references to 46 cases, in 16 of which operative measures were attempted; but in only 5 with success. In all 5 extirpation was the method adopted, which is much preferable to ligature or puncture. The subdivisions which Dr. Braune makes of this class of tumours are not necessary for our purpose.

† *Path. Soc. Trans.* vol. viii. pp. 16-28.

Even after removal from the body, it is not always possible to be confident as to those which contain a number of cysts mixed with various tissues, such as shapeless masses of cartilage and bone, whether these tissues are parts of an undeveloped fœtus or mere accidental formations.*

It appears more prudent, both in cases of subcutaneous parasitic formations and in compound tumours, not to be too anxious to extirpate the entire growth. If the projecting portion which is interfering with the patient's comfort be removed, that is all that may be necessary. A too-deep dissection may easily produce fatal mischief. It does not seem that supernumerary limbs, if amputated, ever grow from their base; and in the case of tumours, though they may certainly grow again, the risk of having to perform a second operation seems to be, on the whole, the less evil of the two. The simple cyst must, however, of course be extirpated entire, if at all.

Congenital malformations of the face are not limited to harelip and fissured palate exclusively, although those malformations form so much the larger part of the whole, that a man may have had an extensive experience in the treatment of them without ever having had an opportunity of seeing the rarer forms.

A condition of the mouth is spoken of similar to that which so often affects the anus, viz. congenital imperforation—atresia oris. It does not seem, however, that any instance is related as having occurred within modern times. The treatment would consist in removing the membrane which closed the mouth, and attempting to unite the skin to the mucous membrane around the opening, so as to promote union by the first intention, without which a recurrence of contraction would be to be feared.

The congenital smallness of the mouth (*microstoma congenitum*) spoken of by Von Ammon and Dieffenbach† appears to be merely a phenomenon of deficiency in the development of the lower jaw, and therefore to be beyond treatment.

A fissure similar to the common harelip is said‡ to have been occasionally noticed in the lower lip; and another similar deformity is that which extends laterally from the angle of the mouth, so as to expose the back teeth.§

Fissures into the nostril through the substance of the cheek are also met with in a few instances.

All such deformities must be treated on the same general principles of plastic surgery which guide us in operations for harelip; viz. to close the opening by drawing over it the soft parts with their raw edges in as neat apposition as possible, and with as little tension as may be. Any adhesions to the bones of the face which render this difficult must be divided. If the cleft be very large, it may be necessary to cut free a flap to glide over and fill it; and in all cases in which the muscles tend to drag on the wound, their action should be neutralised by the "harelip suture."

Congenital absence of the nose has been spoken of, the feature being replaced by two mere openings on the surface of the face; and an operation has been described, which is said to have cured this horrible deformity.|| It is not, however, very clearly described, nor does the case seem to have been

* This remark is illustrated by a preparation in St. George's Hospital Museum, consisting of a number of irregular pieces of bone from a congenital tumour removed by Sir B. Brodie from the sacral region. The operation proved fatal.

† Fritze u. Reich, *Plastische Chir.* p. 90.

‡ Nélaton, *Path. Chir.* vol. ii. p. 699.

§ Von Ammon, *Angeborne Chir. Krankh.* tab. iv. p. 14; Debout, *Bull. de Thér.* vol. lxiii. p. 15. Professor Fergusson, in his lectures recently delivered at the Royal College of Surgeons, exhibited drawings of each of these malformations. *Lancet*, June 25, 1864.

|| Maisonneuve, in *Bull. de Thér.* 1855, vol. xlix. p. 559.

satisfactorily followed up. It is difficult to understand how a prominent feature could be fashioned out of the soft parts, if the nasal bones were wholly absent. In such a case Langenbeck's operation for transplanting the pericræum of the frontal bone might possibly be of service.

The congenital defects of the organs of vision have been spoken of in vol. ii.

The malformations of the brain and its coverings, which give rise to the tumours of the skull named meningocele and encephalocele, will be found described with the other tumours of the same region in the essay on REGIONAL SURGERY.

The next congenital affection which should engage our attention is *spina bifida*. This is a malformation which is seen, perhaps, more frequently than any other except harelip. It may be defined as a congenital hernia of the spinal membranes through a fissure in the walls of the canal. Thus a tumour is formed, which is usually of a rounded shape, lying in the middle line of the back, fluctuating, often semi-transparent, adhering to the bones of the column either directly or by means of a pedicle.

Anatomy. I shall not attempt in this place to describe the anatomy of the rarer forms of *spina bifida*, some of which, such as complete fissure of the whole spine, are incompatible with life, and therefore of no practical interest; while others, such as the multilocular tumours, those which are complicated with complete absence of vertebræ, those which arise from fissure of the body instead of the laminae, &c., are so rarely met with, that each case would require a separate description. Excluding these rarer forms, let us study the surgical anatomy of *spina bifida* in the same manner as that of other herniæ, by describing the composition of (1) the coverings, (2) the sac and its neck, (3) the contents.

1. The tumour is in most cases covered by healthy and unaltered skin; frequently, however, the skin is variously modified from the standard of health. Cases are recorded in which the density of the skin was increased, so that it is described as hard and coriaceous;† but it is far more common to find the skin thinned or even altogether deficient. This is due to one of two causes: either the skin was originally properly formed, with the cutis and epidermis natural, but has become thinned as the tumour increased, or the skin has been congenitally deficient, being represented only by a thin fibrous material (something like a cicatrix) covering the spinal membranes, or even altogether absent, so that a bluish-red membrane permeated by vessels is exposed, which is the spinal dura mater. In some of these cases, it is said that the latter membrane also has been absent, and the arachnoid exposed. When the coverings of the tumour are thin, serum may ooze through them without any actual hole;‡ but ulceration very soon takes place as the tumour increases, and then the sac bursts.

2. The sac of a *spina bifida* is formed of the membranes of the cord matted together; and, in some rare cases where extensive malformation is connected with hydrocephalus, this sac is lined by the substance of the cord itself, spread out into a thin layer on the inside of the membranes. Its neck is formed by an opening in the laminae and spinous processes of one or more vertebræ, and is longer or shorter according to circumstances. When the hole in the canal is large and the tumour sessile, there seems to be no neck; while at other times the tumour hangs down over the child's back by a long stalk, which in one case is said to have been a foot in length.§

3. The contents of the sac are, *first*, in all cases more or less watery fluid—

* See page 233.

† Case iv. in Mr. Prescott Hewett's paper, *Med. Gaz.* vol. xxxiv. p. 460.

‡ Laborie, *Ann. de Chir.* vol. xiv. p. 272.

§ *Boston Med. and Surg. Journ.* 1862, p. 456.

the subarachnoid fluid; *second*, in most instances a portion of the cord itself, or the cauda equina, or some of the spinal nerves; and *lastly*, in very rare cases more or less of connective tissue, or of fat. Spina bifida is caused either by an arrest of development in the arches, or by a dropsy, probably inflammatory, of the membranes before the bones are ossified. Either cause would account for the fact, that the malformation is far more common in the lumbo-sacral region than in all other parts of the spine put together. There are too few preparations of spina bifida in the higher parts of the column preserved, or accurately described, to allow of an opinion as to their usual contents; but it is known that in the common position of spina bifida, the cord, or some important part of it, is almost always contained in the sac.* When the cord itself, or its prolongation, is the part contained, it is always closely united to the back of the sac in the middle line. The nerves either run across the cavity of the sac, or in the substance of its tissues, to their destination.

Symptoms. The symptoms of spina bifida will be easily understood when its anatomy is known. The tumour is always in the middle line, and always attached to the bones. The hole in the canal can be readily felt if the parts which cover it are not very thick. If the skin is thin, the tumour has the transparence of hydrocele. The fluid can often be partly pressed back into the canal, and then tension of the fontanelle, or increase in the size of the hydrocephalus (if the latter exists), will be noticed; nervous symptoms also are frequently produced. The size or tension of the tumour is sometimes increased when the child cries. Symptoms due to interference with the functions of the cord are not infrequent—palsy of the limbs or of the sphincters, and convulsions.

The progress of the disease is usually to death. As the size of the tumour increases, the patient often dies of convulsions, or the skin ulcerates and the tumour bursts; and then palsy or convulsions produce death. But although the great majority of cases are speedily fatal, it is not always so. Many cases are recorded in which the tumour has continued to grow, but not more than in proportion to the rest of the body, and has produced no symptoms—the patient dying at various periods of some other disease.† In other and much rarer cases, the disease has undergone a process of spontaneous cure; the elongation of the pedicle produced by the weight of the tumour having resulted in closure of the orifice of communication with the spinal canal, so that there remained merely a closed cyst, which either remained innocuous or was removed. Finally, recovery has been known to follow on the rupture of the sac.

Active surgical treatment usually hastens death; yet cases have been known to recover after many varieties of operation. It is this fact which makes the interest of the disease, and renders the Surgeon anxious to separate from each other the cases which should be left alone and those which should be treated actively; and further to assign to each class of the latter cases its appropriate method of treatment.

Treatment. The great obstacles to the success of operations for spina bifida are the free communication between the sac and the cavity of the theca, and the probable presence of the cord, or large nerves, in the sac. In consequence of these anatomical dispositions, every active surgical measure is liable to be followed (in fact, will almost certainly be followed) by diffuse inflam-

* Mr. Hewett found only one such preparation out of twenty in which the nerves were not connected with the sac, op. cit. p. 461. The cord has been found in the sac in the dorsal region, Laborie, op. cit.

† The most advanced age to which any patient has been known to survive seems to be fifty; v. Behrend in *Journ. f. Kinderkrankheiten*, vol. xxxi. p. 350. A curious case is recorded in the *Bull. de la Soc. de Chir.* 1860, p. 396, of a man who lived to the age of forty-three, having survived a very complicated operation for the stone, and died of a recurrence of the latter disease.

mation of the spinal membranes, or gangrenous softening of the cord. Now, as every true spina bifida communicates freely with the spinal theca, and as a very large majority of those of the common form (in the lumbo-sacral region) contain the cord or nerves, no further argument is required to prove the expediency of abstaining from active interference. Therefore, in every case of spina bifida in which the child is in good health and the skin does not threaten to burst, nothing should be done, except to support the tumour by means of a concave shield well padded (which may make slight pressure if no pain is produced thereby), and watch the case, in the hope that the disease may remain stationary—perhaps even undergo a spontaneous cure. But what course is to be pursued in cases where the tumour is increasing rapidly, and where the thinness or ulceration of the skin proves that the sac will soon burst; or where it has once burst and the infant has survived; or where convulsions have come on and are frequent and severe; or where hopeless paralysis renders life a burden? It is obvious that in any of these cases the child's condition can hardly be made worse; and the only question is, whether there is enough prospect of doing good to induce the Surgeon to risk the reputation of himself and his art by attempting any thing. Let us recur to our previous statement of the chief obstacles to success, and see whether they can be in any way obviated. The first of these obstacles is, the free communication of the sac with the cavity of the spinal membranes. If, then, this communication could be temporarily obstructed, the interior of the sac might be treated by injection, as congenital hydrocele sometimes is, without any propagation of the inflammation to the general cavity; or might, perhaps, tolerate some of the other methods of treatment to be alluded to presently. Pedunculated tumours, then, are much more favourable for treatment than those that are sessile. Next, as to the presence of the cord. If it be present, it is united to the back of the sac in the middle line, and cannot be reduced or got rid of in any way. The injection of iodine would most likely set up such an amount of inflammation as would lead to paraplegia,* while ligature or any sanguinary operation must be inevitably fatal. To judge whether the cord is or is not present, we have only probabilities to guide us. If the opening into the canal be very small (especially with a voluminous tumour), the cord is the less likely to pass through it, and *vice versâ*. If the tumour can be tapped, and the fluid drawn off without producing nervous symptoms—if there is no increased sensibility in the usual place of attachment of the cord—if the disease, though increasing, is not attended by convulsions—if the tumour is equable in transparence and consistence throughout—if, on tapping the tumour, the trocar can be passed into the centre of the sac without appearing to set up such symptoms as we should expect from touching the cord,—we may fairly act on the assumption that the cord is absent. In cases where it is suspected that the cord is present, no treatment should be adopted, except in express deference to the wishes of the child's parents, and with a full knowledge on their part of the probability of a fatal result.

When the rapid increase in the size of the tumour is the only symptom requiring surgical interference, no more active measures should be employed, until the effect of repeated tapping, followed by the application of pressure cautiously and gradually, has been ascertained. In this way Sir A. Cooper obtained two very gratifying successes.† The tapping should be performed with a fine trocar, introduced always on one side (remembering that the cord, when it is present, is always attached in the middle line), and the tumour should not be entirely emptied at first. After a portion of its fluid has been removed, a pad and bandage, or some apparatus in the form of a bag-truss, may be used; or the skin may be painted with collodion, either

* See a case by M. Viard, *Bull. de la Soc. de Chir.* 1860, ii^{me} sér. tom. i. p. 616.

† *Med.-Chir. Trans.* vol. ii. p. 324.

without puncture or after puncture, the wound having been allowed to heal. If the skin is very thin, the collodion should be used at first diluted with equal parts of castor-oil. A thick layer should be painted on, and the part kept exposed to the air till the fluid has completely dried (say an hour and a half). In a case reported by Behrend,* this plan proved perfectly successful; combined, however, with the internal administration of calomel.

But when the tumour refills as fast as it is emptied by the trocar, some other method must be practised if the child's life is to be saved. The operations which have been used are (1) injection, (2) ligature, (3) excision. Issues and setons have also been employed, but not since the anatomy of the disease has been understood. Their use would now be quite unjustifiable.

1. Injection of the sac is by far the most promising method. Tincture or solution of iodine is the only fluid with which, as far as appears, the experiment has been made; and its success has been sufficient to make us hesitate before using any other agent. In fact, it is difficult to conceive of any other which would unite in so great a degree efficacy with harmlessness. There are two principal methods of using iodine injections in this disease. By the first, which we may call the American method, the sac is not emptied, but a certain amount of the fluid is drawn out of it, and its place supplied by the iodine solution. Even this mixture is sometimes withdrawn from the sac, after having been left to act upon its lining-membrane for a few minutes. This was the method adopted by Brainard of Chicago.† In the other, or the French method, introduced by Velpeau, all the fluid is withdrawn from the sac, which is then injected with tincture of iodine and water, like a common hydrocele. Numerous successes are claimed for both methods. In a report on this subject, published by M. Debout in the *Bulletin de la Société de Chirurgie de Paris*, 1860, p. 612, the reporter states that Brainard had operated in 6 cases, 5 of which had been successful; and that Velpeau's method had been adopted in 10 cases, of which 5 were cured, 4 died, and 1 failed. I must confess that I look on these figures with some slight suspicion. Brainard himself, in reporting a seventh case, gives what seems quite a different version of his success. He says,‡ that he has treated 7 cases of spina bifida with iodine injections; that 3 out of those cases were uncomplicated with hydrocephalus, and that all these 3 were "perfectly and permanently cured." If this is not meant to imply that the others were not cured, it is not happily expressed. But whatever allowance we may make for exaggeration, there is no doubt that injection has proved far more successful than either of the other two plans, and should always be used, when not plainly contraindicated, in any tumour in which active treatment is considered necessary. It is highly desirable, if possible, to stop the communication with the spinal canal, in order that the injection may not excite inflammation in the cavity of the membranes. Therefore, those tumours which are pedunculated, or have a very small orifice, are best suited for this treatment. Superficial tumours are also more likely to be successfully treated than those which are covered with a mass of soft parts, on account of the impossibility of commanding the orifice in the latter.

2. The ligature of the pedicle of the tumour, by instant strangulation, has been practised frequently; but, I believe, always with fatal effect. The

* *Journ. f. Kinderkrankheiten*, vol. xxxi.

† Brainard's method of operating is thus described in his latest published case: Six ounces of fluid were drawn off; half an ounce of a solution of 5 grs. of iodine and 15 of iodide of potassium to the ounce of water was injected, then, after a few seconds, allowed to flow out; next the sac was washed out with water; and finally 2 oz. of the original cerebro-spinal fluid (kept for the purpose at the temperature of the body) was reinjected. All this was done under chloroform, and pressure was afterwards applied. Brainard, *op. infr. cit.*

‡ *Am. Journ. Med. Sc.* 1861, vol. xlii. p. 65.

gradual strangulation of the pedicle by means of quills laid on either side, and brought gradually towards each other, was devised by Benard;* and Dubois effected the same purpose by means of a clamp placed on the neck of the tumour.† A successful operation on the latter plan has recently been performed in England by Dr. Wilson of Claycross, and the parts removed were exhibited at the Pathological Society. The tumour was in the dorsal region.‡ It does not seem essential to the success of this operation that the tumour should be removed; but when the neck has been divided, it may be as well to do so. This plan would be only applicable to the same kind of tumour as the iodine injection, and it appears far more dangerous.

3. There remains the operation of excising the sac. This proceeding, if ever justifiable, must be reserved for those tumours which communicate with the spinal canal too freely to be amenable to the former methods, and those in which the thinness or ulceration of the skin forbids the use of injection. As several cases of successful excision are on record, it would, I think, be rash to proscribe the operation in a disease so fatal in itself as spina bifida. The tumour, if covered with healthy skin and fat, may be laid bare, and the cyst opened by an incision on one side of the middle line, cautiously enlarged to the extent necessary to see into its interior. If the cord or large nerves are seen, the operation must be given up. Otherwise the sac is to be removed, a portion being retained large enough to cover the orifice in the canal completely. This portion is to be implanted into the tissues around the orifice by points of silver suture, and the integument united over it. The only prospect of success for this operation is the faint chance that the parts may heal over the orifice of the sac, without such an amount of inflammation as would spread to the general cavity of the membranes. I have operated once in this manner; but the result was fatal. In a successful case recently reported in France,§ the *écraseur* was used to divide the neck of the sac ("*je ne sais trop pourquoi*," says the reporter of the case naturally enough); and though a hole was left into the spinal canal larger than the end of the finger, the patient (14 years of age) recovered without a bad symptom. Another method of operating with the knife, though it can hardly be called excision, has been practised by Mr. Borlase Childs.|| It consists in opening the tumour, pushing its collapsed parietes back into the canal, and uniting the soft parts over all, tightly enough to prevent the re-protrusion of the sac. The only attempt yet made in this way was fatal; and I confess that it seems to me even more dangerous than excision.

In some works¶ will be found a tabular statement of the supposed indications and counter-indications to operative measures in these cases; but such elaborate statements, while far from being beyond criticism, do not appear to be of much practical utility. No case of spina bifida ought ever to be subject to any active operative interference, except in the most urgent circumstances; and in every case the mildest measure which holds out any rational prospect of cure should be the one selected.

False spina bifida. This term includes several perfectly different forms of superficial tumour, all of which agree in this leading feature, that they communicate with the cavity of the spinal canal, but not with that of the membranes. They are, 1. The sacs of true spina bifida, the necks of which have become obliterated, and which have thus become detached from the membranes. 2. Congenital tumours. 3. Included fetal remains. Like the true spina bifida, these are more common in the lower part of the column.

1. Pedunculated sacs, which communicate with the spinal theca by a narrow channel, may have that channel closed, either by inflammation occa-

* *Gaz. Méd. de Paris*, tom. ix. p. 573.

† Laborie, op. cit.

‡ *Path. Soc. Trans.* vol. xiv. p. 214.

§ *Bull. de la Soc. de Chir.* 1860, p. 664.

|| Behrend, op. cit. case 19.

¶ *E. g.* Behrend, op. cit., adopted from Laborie.

sioned by the dragging of the tumour and the pressure of the parts around, or by the growth of the bones encroaching on the membranous tube. Such is believed to have been the history of a remarkable case, which Mr. Solly has recorded in vol. xl. of the *Medico-Chirurgical Transactions*. It must be allowed that the precise nature of the tumour in this case is doubtful; but other instances (although very few) of this kind of spontaneous cure are recorded.* Its occurrence would be known by the obliteration of the tube of communication between the sac and the laminae, and the feeling of those bones ossified beneath the tumour. Under these circumstances, an operation for the removal of the tumour is justifiable, though it can hardly be considered necessary.

2. Congenital tumours inside the spinal canal are of very various kinds. The most important are found in the sacral region; and these have been discussed in a preceding page (p. 805).

3. The question of included parasites has also been discussed above.

In considering the question of removing a false spina bifida, its connexion to the spinal canal, and to the great cavities of the body (as the pelvis) must be carefully investigated; and in the pelvic region a thorough examination of the rectum and genital organs must be made. If the tumour is free from both these sources of danger, it may be operated on without scruple. If it be in such close connexion to the canal as to lead to the inference that it springs from its interior, but still, from its unvarying size under pressure and from other circumstances, a hope is entertained that it may have no communication with the membranes, it may be made the subject of treatment, should the symptoms justify interference. In that case, if the tumour be purely cystic, iodine injection is no doubt the proper measure; but in mixed cystic tumours this will probably fail. It may be tried, however, if the cyst bears a large relation to the bulk of the whole tumour; and it is not till after its failure that it would be advisable to debate the very difficult and doubtful question of excision.

Imperforate rectum is a deformity which, though sufficiently rare to prevent most practitioners from having much individual experience of it, is yet common enough to cost the lives of many children every year. Now most of those who have seen much of children's diseases will agree that the lives of the majority of these patients might have been saved, and the attendant been more familiar with the nature and treatment of the deformity. In some cases, it is true, life can hardly be preserved; in some it can be preserved only at the cost of the infirmity of an artificial anus; but these are the great minority; in the greater number, if a very simple operation be performed promptly, no traces of deformity will remain in after life. It is very important, therefore, to be familiar with the several kinds of this malformation and with the treatment which each of them requires.

Cases of imperforate rectum may be divided into two classes, viz. those in which no anus exists (imperforate anus properly so called), and those in which there is an anus leading into a cul-de-sac (imperforate rectum in the narrower sense of the term). The former class (imperforate anus) may be again subdivided into—1. membranous obstruction of the anus; 2. complete or partial absence of the rectum; 3. communication of the rectum with the vagina in the female; 4. communication with the urinary tract in the male; 5. external communication, or fistula. The latter class (imperforate rectum) may be subdivided into—1. membranous obstruction; 2. deficiency of the upper portion of the rectum.

Imperforate anus is so far a less dangerous affection than imperforate

* In a debate at the Soc. de Chir. de Paris (*Bulletin*, 1860, p. 387). M. Debout is reported to have said that he only knew of five cases of spontaneous cure: three in the coccygeal region, and two in the lumbar.

rectum, that it attracts immediate notice. Either at the time of delivery, or very soon after, the medical attendant or the nurse observes that the natural opening is absent, or that there is an unnatural one. In cases of imperforate rectum, on the other hand, the malformation is overlooked, and the child's sufferings are at first attributed to every cause except the right one.

1. When a child is born with imperforate anus and without fæcal fistula, the first question is, whether it is not merely an example of the first of the five subdivisions above enumerated. These cases of membranous closure of the anus constitute, I believe, a great majority of the whole; and a simple incision obviates all danger to life. This simple variety is known by the bulging at the situation of the anus, which is seen when the child cries; and also, if the membrane is thin, by the colour of the meconium being seen more or less distinctly through it. But in order that either of these signs may be noticed, the gut must be distended with meconium, which is not always the case at the time of birth. However, if the gut be not full, the child will not suffer any inconvenience; so that in a case of imperforate anus where no bulging can be seen, and no symptoms are present, it is right to wait for a certain time (varying with the progress of the case, a day may be taken as an average), in order to allow time for the descent of the meconium, before undertaking any treatment. When bulging is perceived, all that is necessary is to make an incision of sufficient size in the situation of the natural anus, and give exit to the contents of the gut. This being done, some of the tissue on either side of the incision may be cut away, in order that the opening may be less liable to close, and it must be maintained open by passing a small bougie, or the end of the finger, into it daily, or twice a day, for some weeks. Whether the incision is to be a simple one in the middle line, or a crucial one, appears to be a matter of indifference; but the former is quite sufficient, and the latter is open to the theoretical objection that the fibres of the external sphincter, which is present in these cases,* may be injured. After this operation, if indeed a proceeding so simple deserves the name of an operation, the infant is usually restored immediately to perfect health, and the parts in after life have all the natural appearance and functions. But if no treatment be undertaken (which is unfortunately too common, in consequence of a kind of general impression of the necessary fatality of the malformation), the abdomen becomes tumid and hard, the infant refuses the breast, vomiting comes on, which soon becomes stercoraceous, and the patient dies in a few days from exhaustion, or more rapidly from bursting of the intestine.† If the symptoms have come on before the child is seen, the aspect of the case is less promising; but the same course should be pursued. In a case recently under my care, in which the child was in a state of great distress from distension and fæcal vomiting, rapid recovery ensued on the restoration of the natural passage.

2. When no bulging is perceived after waiting for a reasonable time, it is probable that the lower end of the rectum is deficient. In such a case, if the external parts exhibit no obvious malformation, an exploratory operation should be performed, the object of which is to discover the end of the rectum, and if possible to draw it down, and attach it to the skin in the situation of the anus. For this purpose a free incision should be made from a short distance behind the scrotum, or vulva, in the middle line, to the point of the coccyx; the parts should be carefully dissected, the dissection being conducted along the front of the coccyx and sacrum; and if a bulging tumour can be felt, it should, if possible, be drawn down to the skin, attached there by sutures on either side, and opened; but if this is not possible, it should be opened *in situ*, and after the evacuation of the meconium, gentle traction by forceps should be used to draw it down. If the gut can be attached on either side to

* See *Path. Soc. Trans.* vol. v. p. 176.

† The intestine has given way as early as the fourth day. *Path. Soc. Trans.* vol. ii. p. 226. *Curling, Med.-Chir. Trans.* vol. xliii. p. 305.

the skin, the risk of subsequent contraction of the orifice is much diminished, and the danger of extravasation of fæces into the cavity of the pelvis avoided. If this cannot be done, the opening must be maintained by the daily passage of a bougie, or other dilating instrument. I have found a pair of dressing forceps a convenient instrument for gently dilating the opening. If the opening can be kept to a proper size, even when the gut has not been drawn down, the power of controlling the fæces may be hoped for. A sphincter muscle has been proved by dissection to exist in a case of this kind of malformation. If the gut have been attached to the skin, its circular fibres will assume the office of a sphincter, even when no external sphincter exists.

When the rectum is entirely absent, the above proceeding will fail. The dissection will disclose no bulging tumour; and then the Surgeon will be justified in proposing to open a higher part of the large intestine, and form an artificial anus, in order to save the child's life. The questions connected with this operation will be considered presently.

In cases of imperforate anus where malformation is obvious externally, the parts of generation being very far back, the tuberosities of the ischia very near together, and perhaps the skin in the situation of the anus much depressed, there is more reason to fear that the rectum is altogether wanting, and more danger of wounding the male bladder, or the female uterus and vagina, and the peritoneal pouches, in the dissection, than where the parts are more naturally formed. Hence the exploratory operation must be conducted with great caution; and if these characters are very marked, it will become a serious question whether it would not be justifiable to resort to colotomy at once. It will, however, in most (if not in all) cases be possible, and be the more prudent course, to make an opening between the coccyx and the parts of generation sufficiently large to introduce the finger and feel for the rectum; but in such cases as those to which I am alluding, great care must be taken not to injure the parts in front.

3. The third variety of imperforate anus is that in which the rectum ends either by a small sinus, or by a continuation of its entire tube, in the posterior commissure of the vagina. This is a far less serious defect primarily than the former, since the fæces pass in sufficient quantity to avoid any serious symptoms, and an infant does not suffer any material inconvenience from the flow of fæces through the vagina. Hence the parents often do not present the child for treatment till it is several weeks or months old. But the secondary consequences of the deformity are very serious. The sinus is often not large enough to permit of a sufficient evacuation of the gut, when, with advancing life, the fæces become more solid. This gives rise to increasing distension of the colon, which has sometimes proceeded to a frightful extent and proved the direct cause of death.* Besides, the disgusting nature of the infirmity calls for prompt treatment before the child is old enough to be sensible of its inconveniences. There is usually no difficulty in finding the end of the rectum, by passing a director down the unnatural opening. The perinæum should then be freely divided from a short distance behind the posterior commissure of the labia nearly to the coccyx; and after having, if necessary, opened the rectum by cutting on the director, the operator should endeavour to draw down its walls, separating the front wall from the vagina, and attach them to the skin. If this cannot be done, at any rate a free opening must be maintained in the situation of the natural anus, in the hope that the recto-vaginal fistula may close, which, if it be small, appears to be the case tolerably often. If it does not close, some plastic proceeding analogous to that which is used for rupture of the perinæum in the adult will probably be necessary. But for the success of such operations the bowels must be more under control than can be the case in early infancy; so that it is advisable to delay the operation, and to ascertain, by experiment, before performing it, that the child's bowels can be kept constipated for several days without danger.

* *Brit. Med. Journ.* 1858, p. 845.

4. Communications between the lower end of the bowel and the male urinary organs with imperforate anus constitute perhaps the most troublesome variety of this affection. It is true that the malformation does not prove immediately fatal, since the fæces are at first sufficiently liquid to pass by the urethra without much residuum. But as they become more solid, a residuum is left, which, being impacted in the urethra or bladder, according to the level of the communication, produces the ordinary symptoms of calculus, with perhaps even more than the ordinary amount of retention of urine. It is important, therefore, to operate before this has taken place. We have no means of judging whether the communication is with the urethra or the bladder. If it be the former, the rectum will only be deficient in its lowest part, and the end of the gut will be accessible from the perinæum. Therefore, the proper course is to begin by performing the usual exploratory operation in the perinæum; and if the rectum be met with, to separate it from its connexions, if possible, and draw it down to the skin, as in the last case. I am not aware, however, of a case in which this has been successfully accomplished. If the rectum be not found, the inference is that the communication is with the bladder; and in that case the rectum may be totally absent, and the communicating intestine may be some much higher part of the alimentary tube. In such a case, I think that colotomy should be recommended; but it is a very doubtful question, the decision of which may reasonably be left to the parents, if they are persons of sufficient intelligence. Some further remarks on colotomy in these cases will be found in a future paragraph.

If the child is not seen till a later period, when the symptoms of fæcal accumulation in the urinary tract call for some relief, attention must first be directed to this. The mass must be broken down with the catheter, and removed by the free injection of warm water; or if it be very solid, it may even be advisable to use the lithotrite. Then the case must be treated according to the rules above laid down. The proposal, which has been sanctioned by some Surgeons, of cutting down in the middle line into the urethra and neck of the bladder, and thus laying the whole track for the urine and fæces into one, appears unadvisable, as it would very likely end in leaving the patient with the horrible infirmity of a large cloacal aperture, through which both the urine and fæces would pass without control.

5. The cases of imperforate anus in which a fistula exists opening externally are also not immediately threatening to life; and if the external opening be in a situation where the discharge of the fæces will not be dangerous or very inconvenient (*e. g.* behind the natural position of the anus), it may be a question whether they require any treatment beyond such dilatation as may be necessary for the perfectly free discharge of the fæces. Such openings have been known ultimately to acquire sphincter power. But when the opening lies in front of the natural position (in the scrotum, or close to the vulva, according to the sex), it is advisable to cut down in the proper place, and attach the gut to the skin. The operator may be sure of finding the rectum lying close to the skin of the perinæum. If the abnormal anus be in some remote place (as in the hypogastrium, on the dorsum penis, in the groin), the case assumes a much graver aspect, since the rectum, and perhaps the whole large intestine, may be absent or impervious. In most of such cases it will, in all probability, be judged better to dilate the abnormal anus, if necessary, and abandon the case to nature. In very few instances would it be justifiable to attempt to restore the natural opening.

Besides these cases of imperforate anus, others are occasionally found, with or without fistula, in which the anus is merely narrowed by a membrane, an opening in which allows of some relief to the bowel. All that is necessary is to dilate the natural anus by incision of the membrane, snipping away its edges, and passing bougies. This will suffice for complete cure, if there be no fistula; if there be, it may be expected, if narrow, to close of itself; otherwise it must be treated according to the principles established in the former varieties of the malformation.

We have now to consider the cases of imperforate rectum in the narrower sense of the term, *i. e.* cases in which the external parts are normal, but the anus leads into a small cul-de-sac, the rectum being totally obstructed above. Such cases (as has been before pointed out) usually require immediate treatment; the deformity having been at first overlooked. The obstruction of the rectum may be due to a simple membrane stretched across the tube of the intestine, which in other respects is natural; or the upper tube (the rectal cul-de-sac, as it is called) may lie by the side of the lower (the anal cul-de-sac), or behind it; or the rectum may be impervious for a greater or less distance, so that the colon may terminate by a dilated extremity above the pelvis. In rare cases, the sigmoid flexure itself, and more or less of the rest of the large intestine, may be absent; but as such infants are usually not viable, the cases present little practical interest. Practically, cases of imperforate rectum may be divided, as above, into two classes, *i. e.* 1. where the upper cul-de-sac is accessible from the lower; and 2. where it is not.

The chief means of distinguishing one variety from the other is the sensation of bulging communicated to the finger passed into the anal cul-de-sac. The presence of this symptom may be taken as indicating that the two cul-de-sacs lie close together. As a matter of prognosis, it ought to be borne in mind that this bulging has been felt in a case where it proved to be due not to the impulse of fæces in the rectum, but to that of fluid in the recto-uterine pouch of the peritoneum;* but as an indication for practice it may always be held to justify the Surgeon in exploring the bulging tumour. This may be done either by incision or with a grooved needle. If a puncture is made and meconium escapes, the puncture ought to be dilated with a pair of dressing forceps passed through it, until the meconium has been freely discharged, when a large catheter or tube should be fixed in the gut. If the Surgeon prefers to use a grooved needle, and meconium is detected, the grooved needle may be used as a director, and a small knife be passed along it. M. Guersant has recommended the use of a trocar and canula made in a peculiar form, so that the canula is grooved; but as a grooved needle answers every purpose, I should not be disposed to use a larger instrument. The practice usually pursued, of thrusting about trocars of considerable size in the tissues of the pelvis, is very dangerous; and if the gut is found, the opening made by such an instrument is always insufficient; so that the trocar ought to be discarded in these exploratory operations.

If the gut cannot be found in this way (*i. e.* if there is no bulging tumour, or if the sensation prove deceptive), an operation similar to that for imperforate anus should be first performed. The anal cul-de-sac should be freely laid open towards the coccyx, and the parts in the pelvis dissected to as great a depth as may be thought prudent. On the failure of this operation, the question of colotomy will arise.

Colotomy in congenital obstructions of the lower bowel. When the rectum is entirely deficient, the only means of preserving life is to open some higher part of the bowel; and when the gut opens into the bladder, and is inaccessible from the perinæum, the same operation may be performed, although not immediately necessary for the preservation of life, as a means of avoiding the grave inconveniences and dangers which that malformation entails. The operation may be performed either according to Littré's method, or that which goes by the name of Amussat.† But the former is generally preferred in these cases of congenital malformation for several reasons, although it must be allowed that our experience of either is not sufficient at present to serve as a foundation for any very exact comparison. It may be said, however, that the only difference between the two operations is, that Littré's is per-

* *Path. Soc. Trans.* vol. xi. p. 99.

† These operations are described at pp. 179, 180.

formed a little lower down and farther forward than Amussat's, and that the former necessarily opens the peritoneal cavity, while the latter may succeed in opening the intestine without wounding the peritoneum, in those cases in which the descending colon is not attached by a mesentery. But the latter advantage cannot be always attained, since the presence of a mesentery is not uncommon; and if there be a very long mesentery, it may be altogether impossible to find the large intestine.* Nor does it appear at all certain that the fatality of colotomy in these cases is due in any great measure to wound of the peritoneum. The tender age of the child; the weakness induced by distension, vomiting, and want of nourishment; and the tendency to peritonitis (in some cases its actual existence), from the congestion and straining motions of the intestines,—sufficiently account for the fatal result which usually follows.†

In the rare cases where colotomy has been successful, some of the patients have lived through the ordinary term of human life, and have been able to perform without serious inconvenience the duties of laborious occupations, and the functions of wives and mothers.‡ These cases justify the performance of the operation, when the consent of the patient's friends can be obtained; although it must be admitted that little success can be anticipated.

When the operation has been performed on account of a communication with the bladder, an additional annoyance is experienced in the fact that some fæces may still pass beyond the artificial anus and reproduce the symptoms of vesical irritation. The Surgeon must either deal with the symptoms as they arise, by breaking down the masses in the bladder from time to time, or he may make trial of a plug inserted into the lower opening, or he may even feel justified in attempting to cure the latter by a plastic operation. Space will not permit of a discussion of this rare complication; an interesting example of which is, however, recorded by Mr. Curling.§

A curious discussion has been originated by M. Huguier,|| viz. whether, in performing Littré's operation in cases of imperforate anus, it would not be better to operate in the right groin instead of the left. M. Huguier seems to have accidentally met with several cases in succession similar to the two of Mr. Curling's, mentioned in the note below, and from these to have concluded that this deflection of the sigmoid flexure to the right groin is usual in cases of malformation. This appears not to be the fact, although it may be quite possible that such an arrangement is more common than in the natural condition. On the whole it seems better to operate in the left groin. Whether after failing to find the sigmoid flexure in that part, it would be the better course to make an artificial anus in the small intestine, or to perform a second operation in the opposite groin, must be left to the discretion of the operator. Neither course would have much prospect of success; but if the infant were healthy and strong, the latter might be justifiable.¶

* Mr. Curling practised both operations on the bodies of 20 infants who had attained the full period. Colotomy in the left groin was easy in 18 cases; in the other 2 the bowel curved over to the right side, so that to open it the incision must have been in the right groin. Colotomy in the left loin was easy in 8 of these subjects; difficult in 6; and impossible, without wounding the peritoneum, in the other 6. Curling, *Diseases of the Rectum*, 3d ed. pp. 222, 223.

† M. Guersant opened the colon eleven times in the groin, and once in the loins, without saving one of his patients. Debout, in *Bull. de Théor.* tom. xlix. p. 116. Nor have I been able to find a single successful case recorded since the publication of M. Rochard's paper, although that publication must have given rise to the performance of many similar operations. On the question of wounds of the peritoneum in operations, see the essay on INJURIES OF THE ABDOMEN, vol. ii. p. 441.

‡ Rochard, *Bull. de l'Acad. Imp. de Méd. an 1859*; Curling, op. cit. p. 229.

§ Op. cit. p. 226.

|| *Bulletin de l'Acad. Imp. de Méd.* tom. xxiv. 1858-9, pp. 435, 445.

¶ Mr. Bryant (*Surg. Dis. of Children*, p. 40) gives his sanction to M. Huguier's suggestion, and quotes a case in which he did succeed in finding the descending

In the *Bull. de l'Acad. de Méd.* tom. xxiv. 1858-9, p. 434, Velpeau gives the following advice. He operated on an infant with imperforate anus. Not being able to find the rectum by operation in the perinæum, he resorted to lumbar, and then to inguinal colotomy; but gives no particulars of the operations. On the death of the infant, the rectum was found complete, but empty, and deviated to the right. He therefore advises that, after having opened the gut in the loins or groin, a probe should be passed down to ascertain whether the lower part of the gut is not present, and whether it may not be possible to establish the natural anus.

Malformations of the umbilicus. Another affection, probably due to congenital malformation, is that warty or nipple-like tumour projecting from the umbilicus, which is tolerably often seen in children, and seems due to some morbid condition left by the separation of the umbilical cord. Mr. Athol Johnson, to whom we appear to owe our first accurate description of the disease in the English language,* speaks of it as "a stout nipple-shaped papilla or tubercle, rising from the centre of the main umbilical depression;" and says that he has seen it attain the height and circumference of an inch. I have had several cases, but none of this size. Mr. Cooper Forster and Mr. Bryant also speak of this affection. In most cases the tumour is solid, in some a minute canal extends along it for a short (but only a short) distance. No water flows along this little canal, nor does the canal lead into the bladder. The treatment of these cases is exceedingly simple; a ligature tightly applied being all that is necessary.

Umbilical fistulæ. There are other though less common cases in which the urachus remains open,† and the urine is discharged from the navel; or in which there is a fecal fistula, congenital or acquired;‡ or in which there is a biliary fistula at the navel.§ These cases must be distinguished from the foregoing trivial affection, as can readily be done by the character of the discharge.

The cure of such fistulæ should be attempted, but with caution. The actual or potential cautery applied to their edges can do no harm. It has, however, failed in all the cases that I am acquainted with, and then a plastic operation ought to be attempted. But I cannot encourage the reader to be very sanguine of success by this method either. In the two cases related by

colon by an opening in the right groin, the gut having made a turn across the abdomen from the left loin. But the case, as related by Mr. Bryant, hardly proves much for the value of the suggestion, since he does not assert, nor does his description prove, that the colon could not have been reached from the left side of the abdomen equally well. In these cases where the gut turns across the abdomen, it is usually possible (as it seems to have been in Mr. Bryant's case) to infer this condition by the percussion-note; and it would then be perhaps advisable to make the incision somewhat higher than usual.

* *Lectures on the Surgery of Childhood*, 1860, p. 44. The affection is said to have been first pointed out by Dugès, *Diet. de Méd.* en 15 tomes, t. xii. p. 159.

† In the *Med.-Chir. Trans.* vol. xxxiii. p. 293, there is a case reported by Mr. Paget, of Leicester, of patent urachus, in which the patient, a man æt. 40, laboured under symptoms of stone. The unnatural opening was of large size, an inch in diameter; notwithstanding which he could retain about a pint of water, and only a little escaped in micturition. There was also hernia at the opening. The calculus had formed on a hair, which had probably slipped down accidentally from the pubes. It was extracted by passing the finger down the patent urachus. No operation was attempted on the patent urachus. See also Bryant, *op. cit.* p. 144.

‡ Cooper Forster, *Surgical Diseases of Children*, p. 107.

§ I have seen no published case of this affection; but a boy, æt. 10, was under my care in the year 1862, on account of a discharge of pure bile from the umbilicus. This was said to have followed the removal of one of the warty tumours above described. The fluid responded to the usual tests for bile, and, as well as could be ascertained, was free from any fecal admixture. The sinus from which this fluid exuded was so minute, that I could form no idea of its direction, but it seemed to extend a considerable distance.

Mr. Cooper Forster such an operation was performed; but it does not appear to have succeeded in either. Mr. Bryant's case was not made the subject of any treatment. In mine the treatment by cautery failed, and I lost sight of the child before performing the plastic operation which I contemplated.

Hermaphroditism. Most of the malformations of the genito-urinary organs have been treated of in former pages of this volume: the malformations of the male urethra, producing hypospadias and epispadias, at p. 382; those of the penis which accompany extroversion of the bladder, at p. 339; those of the vagina and uterus, at p. 492; and those of the testes, at p. 540. There remains, however, the question of doubtful sex from malformation of the external organs, which is often brought to the Surgeon to decide, and, as it seems, is often decided wrongly. The male organs may simulate the female in this way: the corpus spongiosum and the corresponding portion of the urethra are absent; the penis is small and the prepuce imperfectly formed, resembling a large clitoris; the scrotum is split, leaving a gap which represents the vagina; its two halves form cutaneo-adipose folds, representing the labia majora, between which is the orifice of the short urethra; and the resemblance may be completed by the testes being retained in the abdomen. The female organs may simulate the male by a great enlargement of the clitoris, causing it to resemble the penis, the presence of the ovaries in the labia,* and a very small vaginal orifice like the opening in hypospadias. The majority of cases of spurious hermaphroditism in the female present, however, merely the enlarged condition of the clitoris, and may be recognised for females with tolerable ease, by passing a sound up the urethra into the bladder, and examining by the rectum. The presence of a uterus and vagina between the finger and the sound will then be evident. Even in the rare cases where the ovaries may have descended into the labia, on one or both sides, this method of examination may yet clear up the matter; and if the vaginal opening be large enough to admit the finger, no doubt need exist. The question is often more puzzling in cases which are probably males, with cleft scrotum; as is evidenced by the case quoted by Dr. Simpson† from Otto, where an individual had lived ten years as a wife with three different men, who was yet afterwards affirmed by the Royal Medical College of Silesia to be a male. At the Pathological Society a short time since, a specimen was exhibited which elicited opposite opinions from very good authorities. Nor is it impossible that true hermaphroditism may in some cases exist—that is to say, that some parts of the male and female organs may coexist; as in the case of the sheep, described by Mr. Savory in *Med.-Chir. Trans.* vol. xlii., where along with testes and other male organs there was found a very perfect uterus and vagina. Also in the *Pathological Transactions*, vol. xi. p. 158, is the account of the dissection of the generative organs from a person regarded (and apparently correctly) as a female, but where a body much resembling a prostate was found; the urethra had the long course of the male, and the vagina could hardly be demonstrated. Some other cases will be found recorded by Dr. Simpson. Leaving aside, however, a few rare cases in which some doubt may exist, the careful examination of the folds simulating labia may detect a testis and cord (or a cord with rudimentary testis) on one side or both; or the proximity of the urethra to the rectum, with the development of the perinaeum, may prove the sex to be male; or the direct continuity of the supposed vaginal canal with the bladder may show that it is really a male urethra. Occasion-

* This is not so very uncommon. A case was recently laid before the Royal Medical and Chirurgical Society where Mr. Lawrence, operating for strangulated inguinal hernia in the female, found the ovary in the sac. Mr. Pott's case is also well known.

† *Cycl. of Anat. and Phys.* art. 'Hermaphroditism,' the standard reference on this subject.

ally it is said that extroversion of the male bladder has been mistaken for the vulva, or that an adhesion of the penis to the scrotum has caused a doubt of the sex of the child. Such conditions, however, can hardly deceive one who is prepared for their occurrence.

In the few cases where the above tests give only uncertain results, a doubt must be allowed to rest on the sex of the child, which perhaps will be cleared up by the development of the breasts and the propensities displayed at puberty; or which may remain until dissection clears up the difficulty. In all cases of true hermaphroditism the sex would be settled by the intrinsic organs (testes or ovaries) which are found on dissection. When doubt exists as to the sex of a child, it appears more prudent to bring it up as a male than to expose it to the disgusting and disappointing consequences of an attempted marriage.

Malformation of skin. The congenital^{*} vascular tumours, or *nævi*, have been noticed above, with respect to their surgical treatment (TUMOURS, vol. i. p. 500). But besides these tumours there are other malformations, which consist chiefly in a mere discoloration, often accompanied by a development of hair. Of the more extensive discolorations (which are more common on the face than elsewhere), the common "port-wine stain" is the most familiar example; and of those attended with development of hair, the ordinary mole (p. 759). But there are rarer deformities of each kind, or involving a mixture of both kinds. Mr. Athol Johnson informs me that he was lately consulted on account of a fine healthy baby, with an irregular dark-brown (almost black) streak extending across the root of the nose and invading the inner extremities of the eyelids on each side. The skin was thickened, and irregularly wrinkled and slightly elevated, and its surface was covered with short dark hairs. In this case the extent of the disease forbade any endeavour to extirpate it, which, however, in such affections it is particularly desirable to do if possible, both as a matter of appearance and from the reputed liability of moles to become the seat of epithelioma. In the case of extensive maculæ no treatment seems to have any effect. In those less extensive, the skin may be destroyed by some powerful caustic, and thus the less disagreeable deformity of a white scar substituted for the stain.

Malformations of limbs. The malformations resulting from congenital dislocation and fracture will be found described in the next section, by Mr. Brodhurst. Of other malformations of the limbs it seems hardly necessary to say much. Some of them do not admit of any treatment, and are only interesting in an anatomical and physiological point of view, such as the specimens of entire absence of bones and limbs;[†] while in others the only question is whether the patient would be more comfortable with or without amputation. In the upper extremity the chief question will be as to the power of motion and prehension in the malformed hand, or claw, as the case may be; in the lower, as to the feasibility of adapting a stump to the part before or after amputation. It is therefore but rarely that amputation would be recommended in the upper limb, while in the lower it is often, if not usually, advisable.[‡]

There are other deformities which may be produced by the pressure of the foetal cord in utero, and in which, though the limb has not been amputated, it is distorted in various directions, and deep grooves are marked upon it, where the muscles appear to have become atrophied.§ If any treatment can

* It might be worth while to remind the reader, in passing, that though probably all *nævi* owe their origin to some congenital condition, yet they are often, perhaps usually, not noticed till a short time after birth.

† For an extreme example, see a case figured in *Path. Soc. Trans.* vol. x. p. 308, where all four limbs were entirely absent; and the child (who had attained the age of 5½, and was healthy and intelligent) consisted of a head, neck, and trunk only.

‡ See a case and drawing by Mr. Lonsdale, *ibid.* vol. iii. p. 464.

§ See a case by Dr. Little, *ibid.* vol. i. p. 331.

be available in these cases, it must be directed to bringing the limbs gradually into natural position by pressure appropriately directed, and by passive motion, and at the same time stimulating the muscles by friction, liniments, &c.

Polydactylism. The most frequent malformation about the limbs, and one of the most common in surgical practice, is what is called polydactylism; that is to say, supernumerary fingers and toes. Instances in which a more or less perfect additional thumb exists are very often seen in our hospitals; and numerous examples prove that the defect is often hereditary. It is advisable to remove supernumerary thumbs or fingers early, since they are only in the way; but in doing so some little care is required, as the supernumerary digit often shares in the articulation of the natural one to its metacarpal bone; so that if the whole of the last phalanx of the supernumerary digit were removed, the natural joint would be laid open, and ankylosis might result, which would leave the finger or thumb stiff and extended; therefore the part must be carefully examined, and if even a doubt exists, the phalanx should not be entirely removed, but, flaps having been cut long enough to cover it, it should be divided with bone-nippers near its articulation. No deformity will be perceptible when the child grows up, as the little piece of phalanx left behind will not grow, but will be buried in the soft parts when the hand has attained its full size.

In the foot, supernumerary digits are matters of less consequence. If there be but one, and that not sufficiently prominent to cause inconvenience in wearing the shoe, or an unsightly breadth of the foot, there can be little motive for interference. Mr. Athol Johnson has recorded a case in which the remarkable number of nine toes, more or less perfect, were found on one foot; and the reader who is curious in this matter will find there a full account of the dissection of the part after removal.*

Webbed fingers is another very common deformity; and (unlike supernumerary digits) it usually occurs symmetrically on the two hands. It is most common between the last two fingers. The same condition is also found in the toes; but is a matter of no consequence whatever there. In the hand it appears to be exceedingly desirable to remedy this condition if possible; not merely on account of the use of the fingers, but also as a matter of appearance. The webbed fingers often enjoy a large share of usefulness; and the person can soon accommodate himself to his circumstances; but every visible variation from natural conformation is a source of annoyance and hindrance to a child, and should by all means be remedied if it can be done without danger. Of course, nothing is more easy than to cut the fingers apart; the difficulty which is experienced is in preventing their growing together again. Various plans have been adopted. The band having been divided completely down to the cleft, the edges of the wound may be brought together down to the apex of the incision, in order to procure union by the first intention. If the edges will not of themselves come together without force, a portion of skin may be transplanted so as to fill up the cleft; for it is in the cleft that the tendency to cicatrization is manifested. Or the wound may be left to granulate, care being taken to press something like a band of string or metal into the cleft, in order to prevent adhesion there; the foreign body being fastened to a bracelet. Or, which seems the most promising plan, a large metal ring may first be passed through a hole made at the cleft, and worn there like an earring till the sides of the hole have cicatrised. After the posterior angle of the wound is thus secured against the formation of adhesions, some one or other of the above plans may be adopted with better prospect of complete success. But even if the adhesions do form to some extent, and so render the fold between the fingers deeper than natural, this is a much less conspicuous defect than the former, and besides is not irremediable by further operation.

T. HOLMES.

* *Path. Soc. Trans.* vol. ix. p. 427.

Congenital dislocations. Certain dislocations are found at birth, and they are therefore termed congenital. These luxations occur especially at the hip-joint. Other joints also are affected, however; such as the knee, the wrist, the shoulder, the elbow, and the jaw. The last-mentioned dislocations are always connected with monstrosity, paralysis, or alteration of the articular surfaces, and they are more frequently sub-luxations than true luxations.

The only congenital dislocations which will be treated of here are those of the head of the femur; but it may be well first very briefly to allude to some other joints.

Together with anomalies of organisation every form of congenital dislocation may be found; and also without monstrosity some irregularities occur, which are sometimes treated of as dislocations, but which are slight displacements through paralysis or muscular retraction. Such are congenital dislocations of the shoulder.

These are not true dislocations, but partial displacements with paralysis, approximating more or less in appearance to true dislocations, perfectly reducible, and induced through injury at birth. The example which was adduced by M. Gaillard was probably of this description. The title under which the case is given runs thus: "*Observation de luxation congénitale de l'humérus, réduite au bout de seize ans.*"* Bouvier, who had to report on it, considered that the dislocation was not truly congenital; but the result, he said, was extremely remarkable, the dislocation having existed for fifteen or sixteen years.†

It cannot be doubted, on reading the case as given by Gaillard, that this lesion was not a true dislocation, but that the displacement was due in the first instance to paralysis, and that it was probably subsequently somewhat increased through muscular retraction. The removal of such forms of paralysis and consequent displacement is not so rare that a single fact of this nature should have been thought worthy of a place in the *Mémoires de l'Académie Royale de Médecine*.

Congenital dislocations of the knee are sub-luxations, which require to be treated as contractions, namely, by extension of the limb after subcutaneous section of the ham-string tendons.

Excessive flexion of the wrist and elbow are by some understood as dislocations. These positions are due to muscular retraction alone. Congenital dislocations of these joints are always connected with malformation or monstrosity.

An instance of congenital dislocation of the jaw is recorded by R. W. Smith.‡ The individual was idiotic, however.

Without further preface, then, dislocations of the head of the femur may be considered.

Congenital dislocations of the head of the femur occur in three directions; namely, upwards and outwards, directly upwards, and upwards and forwards. The first-mentioned variety, or that upwards and outwards, alone demands attention; the other two forms of dislocation having only been seen in foetal monstrosities.

Dislocation of the head of the femur upwards and outwards, on to the dorsum of the ilium, occurs for the most part as a double luxation, both sides of the body being affected; and it occurs much more frequently in the female than in the male. Thus of twenty-six cases which were seen by Dupuytren in the course of twenty years, two or three only were single, and only four of these luxations occurred in males.§ Of twelve cases which have

* *Mémoires de l'Académie Royale de Médecine*, tom. ix. p. 702, 1841.

† *Bulletin de l'Académie Royale de Médecine*, tom. v. p. 295.

‡ *A Treatise on Fractures*, &c. chap. ix. 1847.

§ *Leçons orales de Clinique Chirurgicale*, tom. iii. art. 8.

come under the author's care, ten were double luxations, nine of which occurred in females. One of the single luxations also was in a female child.

This affection is supposed by some to be hereditary. The belief rests on the statement of Dupuytren,* which, however, is insufficiently supported.

The *causes* of this dislocation have excited considerable discussion, and various theories have been propounded in support of the different views which have been advanced. This subject has been considered especially by Palletta,† Dupuytren,‡ Pravaz,§ R. W. Smith,|| Jules Guérin,¶ and Carnochan.**

Disease within the articulations of the foetus is supposed by some to give rise to dislocation. Diseases of an inflammatory character occur in the foetus, and of these affections synovitis is one—synovitis both of a gouty and a syphilitic character. It cannot be doubted that, effusion taking place within the joint, dislocation might occur. Proof is wanting, however, that this has absolutely taken place; yet this view, which originated with Ambroise Paré, finds supporters in Sédillot, Malgaigne, Gerdy, Parise, and others.

Again, it has been thought by Breschet and others that arrest of development is the cause of these distortions. But Cruveilhier tells us that he has found both the head of the femur and the cotyloid cavity progressing to their normal development in cases of this dislocation. He speaks of these luxations, however, as *vices de conformation*, and he represents in his first plate a full-grown foetus, with club-hands and club-feet, and with congenital luxation of the heads of the thigh-bones, without testes and kidneys, and with other deficiencies. In this instance the ligamentum teres existed; the heads of the thigh-bones were flattened and deformed, and the cotyloid cavities were shallow.††

Original defect in the organisation of the germ was the theory propounded by Dupuytren to explain these lesions; and he suggests that, considering the perfect health of these infants at birth, and the absence of disease, either past or present, of the head of the femur or in the cotyloid cavity, this hypothesis is necessary to account for the luxations. It receives no support, however, from physiological facts, nor from the consideration of the laws which govern the evolution of the embryo.

Carnochan supposes that "a pathological spasmodic retraction of the muscular tissue, resulting from a perverted or disturbed condition of the excito-motor apparatus of the medulla spinalis," gives rise to this displacement. He continues thus: "Congenital displacements occurring at the ilio-femoral articulation result from active morbid muscular retraction; that morbid muscular retraction itself is to be traced to a morbid condition of the central ganglionic mass of the cord; and this pathological condition is either located in the ganglionic mass, or conveyed thither by the incident-excitor nervous influence of the excito-motor apparatus of the medulla spinalis."

External violence has been thought to be a cause of congenital dislocation since the time of Hippocrates. It has been shown that external violence may occasion fracture in utero;†† and Carnochan believes that it will produce fracture rather than dislocation.

Considering the position of the foetus in utero—that the thighs are flexed upon the abdomen, and that the heads of the femur must therefore make pressure upon the posterior and inferior portion of the capsule of the joint—it may be inferred that external violence, giving rise to spasmodic muscular action, might cause the head of the femur to pass from its shallow acetabulum and lie upon the brim. But the head of the femur having passed the border

* Op. cit. p. 217.

† Op. cit.

|| A Treatise on Fractures.

** On Congenital Dislocations.

†† Anatomie Pathologique du Corps Humain, tom. i. p. 1.

‡‡ Med.-Chir. Trans. vol. xliii. art. 8.

† De Claudicatione Congenita.

§ De la Curabilité des Luxations.

¶ Recherches sur les Luxations Congénitales.

of the cotyloid cavity, nothing more than extension of the limb at birth is required to displace the bone upon the dorsum ilii—the external iliac fossa being the ultimate position of the head of the femur in congenital luxation. Again, violent or sudden traction at birth may doubtless induce this form of luxation; and it is probable that congenital luxations with perfect development of the head of the femur and the cotyloid cavity are thus produced, some impediment having occurred to delay the completion of the birth.

The *symptoms* of this form of dislocation differ as the age at which the lesion is observed differs. At birth it passes unobserved. And, indeed, there is nothing to attract attention to the displacement: it is painless, or if not painless, it is not observable, for the direction of the limb is not sensibly altered, and the motion of the head of the bone is free. Doubtless if the limb were examined with a view to dislocation, the displacement would be discovered.

When the child is lying down, the head of the femur is very slightly prominent; it may be distinctly felt, however, on rotating the limb. In the erect position the head of the bone becomes much more prominent, and it presents visibly on the dorsum of the ilium above and behind the cotyloid cavity.

When the dislocation is double, the pelvis is rendered very oblique, the pubes being carried backwards and the sacrum being raised; the abdomen is prominent and the lumbar region is remarkably hollow—lordosis; while, for the sake of equilibrium, the shoulders and upper part of the trunk are thrown back. The trochanters project abnormally and approach nearer to the crests of the ilia than in their natural condition, and the heads of the femur can be seen projecting on the ilia beneath the glutei. These several points are well shown in the opposite woodcut.

The muscles of the lower extremities, from insufficient use, are small; the thighs have an inward direction, constituting in some cases genu valgum; while the feet are thrown somewhat outwards, and the sole of the foot is rendered flat—valgus.

The gait in double dislocation is most peculiar and unmistakable: no other motion is like that which is occasioned by this lesion: it is a rolling motion of the trunk together with double lameness; and yet it is painless and rapid.

When the head of the femur is dislocated on one side only, the limb is shortened, and the toes only are brought to the ground in walking, the heel being elevated. There is much lameness on the affected side, and the limb is smaller than the other. The obliquity of the pelvis is not so great as when the dislocation is double.

In the recumbent position the lumbar curve is effaced, and the thigh-bone may be drawn down and its head retained against the acetabulum. Shortening of the limb then disappears, and its general appearance becomes normal.

At birth the mobility of the limb is too great. As age advances, deformity increases, and at the same time the hope of restoration of the limb diminishes.

The morbid appearances which are met with in cases of this dislocation vary according to the age of the individual. As has been already explained, only one form of congenital luxation occurs, except with foetal monstrosity, namely, dislocation upwards and outwards. Soon after birth the acetabulum is scarcely altered in shape and dimensions, and the head of the femur also retains its normal appearance. Changes, however, soon take place both of the head of the bone and in the cotyloid cavity, the cotyloid cavity being filled up with cellulo-osseous material, and the head of the bone being flattened and rendered irregular in form, deprived of its articular cartilage, and atrophied.

The capsular ligament becomes elongated, but it may retain its integrity for many years. At length the head of the femur may escape through its capsule and come into direct contact with the ilium; and the ligamentum teres is stretched and becomes slender, and finally it gives way.

But the head of the bone having passed through the capsule, a false articulation commences to be formed. First, a new capsule is formed, and osseous matter is thrown out upon the ilium, which is fashioned more or less into an acetabulum, giving lodgment to the head of the bone.



The *treatment* of this affection is extremely simple, and in its earliest stage it is much more hopeful than is generally supposed.

If dislocation occurs without other abnormality, the acetabulum and the head of the bone are usually perfect at birth. There would then be neither difficulty in reducing the dislocation nor in retaining the head of the bone in the acetabulum; the diagnosis would present the only difficulty. When, however, the dislocation being overlooked, its reduction is not undertaken until several months or years have elapsed, changes will already have taken place which tend to impede the reduction, and to prevent the head of the bone being retained in the acetabulum. Absorption of the head of the bone advances, at the same time that the acetabulum is being filled up. Retraction of the tissues around the head of the femur also is going on, together with thickening, preparatory to the formation of a new joint.

At birth the diagnosis can only present a certain difficulty when the luxa-

tion is double. When it is single this can scarcely occur. The difference in the length of the limbs, and especially the difference which exists on the two sides of the pelvis, will discover the dislocation.

Generally, however, the dislocation is only discovered when the child begins to walk; then the peculiar gait, and the obliquity of the pelvis, are certain to attract attention. The peculiar roll of the body when the luxation is double, and the limp when it is single, have only to be seen once, ever after to be recognised.

The treatment of this luxation should be undertaken within a fortnight or a month after birth, or as soon after as the dislocation itself is discovered. For many months the head of the femur may be drawn down to the acetabulum with the greatest facility, and it may be retained there by means of bandages alone. But later, when pathological changes have taken place, it becomes extremely difficult to replace and retain the femur in its normal position. This can then only be done by means of weights and pulleys, which are applied to the limb on an inclined plane; the weight of the body being entirely removed from the lower limbs. After the femur has been reduced, a metallic cingle may be so fashioned as to fit exactly to the pelvis and to the head of the bone, so as to retain it in situ.

After the head of the bone has been somewhat fixed in the acetabulum, the child may be allowed to move about in a go-cart, the toes just touching the ground. This motion of the limb will be beneficial in restoring the functions of the joint.

If treatment commences after the child has been walking about for months or years, the prognosis must be unfavourable. The head of the femur may be reduced, however, and it may be retained in situ by means of a metallic cingle. If the child can then be persuaded to work a velocipede—the trunk being held in a recumbent position, and the limbs being left free—much benefit may result; and eventually the head of the bone may perhaps remain fixed in the acetabulum.

Fractures in utero. Intra-uterine fractures of the long bones are rare. They occur, however, both as simple and compound fractures. Montgomery has placed on record the following instance: "I saw," he says, "a woman, eight months pregnant, fall from a window, twenty-five feet, into the stony street, on her face. Her hip-joint was dislocated, and her face and hands were cut; but the uterus was not ruptured. She was delivered that night of a dead child, which had some of its bones broken, and which had sustained several other injuries. She recovered perfectly."^{*}

Fractures of the fetal skull have been frequently observed: numerous cases are on record. These are for the most part incomplete fractures, where the bone becomes bent; and they are produced by the pressure to which the head is subjected in its passage through the pelvis; or they are occasioned by the mechanical force of the forceps of the accoucheur.

There is also another class of cases which has attracted considerable attention, and which is mentioned by authors under this title of intra-uterine fractures—solutions of continuity, namely, occurring in a cartilaginous or very imperfectly ossified skeleton. This condition is, however, now known as congenital rickets; and it is a condition differing so widely from that of fractures in utero, that it will only be necessary to allude to it. Grätzer, Maunfeld, Amand, Barker, Chaussier, D'Outrepont, and some others, have directed attention to these solutions of continuity.

Among fractures in utero, those cases which offer the most interest are fractures of the long bones, whether simple or compound, in which reunion more or less complete is observed at birth; or where other proof exists of the fracture having taken place prior to the commencement of parturition; frac-

^{*} *Exposition of the Signs and Symptoms of Pregnancy*, case 42, p. 680, 2d ed.

tures, consequently, not only occurring in utero, but which have not been produced by manipulations of whatever kind during the period of parturition. Such cases are recorded by Ploucquet, Kopp, Devergie, Carus, Schubert, Sachse, and Moffat. For the cases themselves, I must refer to the *Medico-Chirurgical Transactions*, vol. xliii. 1860, art. 8. In one instance, the fractured extremity of the bone appeared in the wound; the periosteum was destroyed, and the lips of the wound were pale and flabby. In another, the bone protruded fully an inch, and it was carious. In a third case, the uterus was wounded, and blood escaped per vaginam. The fracture had reunited at birth, and the leg was one inch and three-fourths shorter than the other. The following outlines of cases, which I saw together with Dr. Gream and with Mr. Gardner (which are also related in the paper above alluded to), are not without interest.

In the first case, it was observed, at birth, that there was considerable swelling about the right knee, which at length terminated in abscess. There was also a second swelling at the upper part of the thigh; but this subsided without breaking. At the knee, however, it was found, as the swelling subsided, that an abnormal condition of the bone existed. The leg could only be partially flexed, and it could not be fully extended. The extremity was both shorter and smaller than the other.

It appeared to me in this instance that there had been a fracture through the epiphysis, by which the inner condyle of the femur was broken off. The condyle projected in front of the shaft of the femur, and it had been rotated outwards.

In this instance, the mother had fallen downstairs while in the seventh month of pregnancy. She struck the abdomen in falling, and she was much hurt. Uterine pains were felt, but they passed off, and the child was not born until three weeks after the accident.

In the second instance, I saw the child some few hours after birth. It was very small, and so ill-nourished that it seemed very doubtful if it could live longer than some few days. The trunk and head were well formed; but the extremities were not in a normal condition. There had been a compound fracture of the tibia in each leg. The fractured bones had reunited somewhat irregularly, the lower portions having been drawn upwards, and the flesh-wounds had not closed. The ulna was wanting on either side, and the lower portion of the fibula was also wanting in each leg. The hands and feet were deformed, and there was double talipes varus.

In this instance two accidents had occurred: one during the fourth month of utero-gestation, when the mother narrowly escaped being precipitated into a deep ravine; and secondly, she suffered a severe succussion in a railway train, six weeks before giving birth to the child. It is probable that the first accident may have occasioned the malformation, and that the railway accident may have produced the fractures.

The causes of fractures in utero are twofold. They are induced, on the one hand, by pressure, such as is made by the forceps of the accoucheur; and, on the other, by muscular action; and it is probable that these are the only forces which can act on the foetus in utero to cause fracture, except in such an instance as that which is related by Montgomery, where the effect of a *contre-coup* may well have operated to produce fracture. So long, however, as the membranes remain unruptured, it is impossible to produce the effect of *contre-coup* on the foetus; neither is it possible that the walls of the uterus shall compress the foetus to produce fracture so long as the liquor amnii remains to distend the membranes; and we must, therefore, believe that in these instances of fractures of the long bones, the fracture has been produced by the sudden and violent action of the muscles of the limb itself.

Malformation doubtless favours both fracture and distortion, as was clearly the case in the last instance which I have quoted; for here the muscles acting irregularly, through the partial absence of their bony attachments, their opponents readily distort the limb. And the same argument holds good equally

of fracture as of distortion; the muscles of the limb acting suddenly and violently on a malformed limb may readily fracture the bone.

The *treatment* of these accidents scarcely requires separate notice; for the bones, at this early age, are so soft and pliable that they may be easily moulded into almost any form. It will sometimes be found, however, that in straightening the bone, however slowly it may be done, the muscles of the limb are rendered rigid; and it becomes necessary, in order to avoid injury to the soft structures, to divide the tendons of those muscles which are rigid,—those muscles probably which, by their powerful contractions, have induced the fracture. After division of the rigid tendon or tendons, the limb is readily brought to its normal form by the use of bandages and pliable splints.

BERNARD E. BRODHURST.

Injuries in childhood do not require notice here, since each injury has been already made the subject of a separate description. All that need be said is, that all injuries, both wounds and fractures, and particularly their combination into compound fractures, are more hopeful in the child than the adult, that they heal more rapidly, and that amputation is less necessary.

Congenital tumours and tumours in childhood. Tumours in childhood do not differ essentially from those in more advanced life, but are usually of looser structure and more rapid growth. Thus malignant disease affects the medullary rather than the scirrhus form; it grows quickly, and proves speedily fatal if left alone, and if extirpated generally returns in a very short time. The eyeball and orbit are its favourite seats, but the bones are frequently affected. The congenital occurrence of cancer is said to have been observed occasionally.* Amongst innocent tumours, the softer varieties—fibro-cellular, fibro-plastic, &c.—prevail over those of more perfect development. Whatever be the presumed anatomical structure of the tumour, its early removal is imperative; not merely on account of the deformity and functional disturbance which it may produce, but also in order to obviate the effect on the nutritive process which is produced by the rapid growth of a tumour. I have had frequent opportunities of convincing myself that the general health improves quickly, and the child begins to gain flesh and strength, after the removal of a tumour which has previously been increasing rapidly. If so, the inference is obvious, that such rapid growth ought to be rendered impossible, by removing the tumour in its stage of quiescence, in every case where this can safely be done; while, if the growth be advancing, the operation is still more urgently requisite.

The chief peculiarities, however, of tumours in early life are observed in those growths which are congenital. Many congenital tumours are formed by single cysts, which sometimes contain clear serum (as in hydrocele of the neck), sometimes dermoid structures (as in the cysts which frequently present themselves at the upper corner of the orbit), sometimes blood, or fluid exactly like blood (as I have seen in a large cyst occupying the whole thickness of the cheek), and at other times various modifications of serum. Again, other congenital tumours are entirely solid;† and although some of them grow rapidly, they have no character of cancer;‡ while others remain stationary for long periods, and then begin to increase.§ Between these two forms (the solid and the cystic) there are numerous transitional kinds. In the neck, the

* Walshe, on *Cancer*, p. 146.

† See a paper, by the author, on congenital innocent tumours, *Lancet*, May 21 and 28, 1864.

‡ *E.g.* the cases numbered 4 and 5 in the paper referred to.

§ *Ibid.* case 3; also a case, by Mr. Mason, of congenital tumour of the tongue, *Path. Soc. Trans.* vol. xv.

occurrence of a widely-diffused and rapidly-growing tumour, composed of soft solid, with numerous cysts scattered about it, has often been pointed out;* and a similar admixture of cysts and solid substance is noticed in congenital tumours in other parts of the body, where the cellular tissue is lax, as in the orbit (see case 5 in the paper above referred to). When formed entirely of solid tissue, this solid is usually of a soft consistence, whitish, and resembling udder on section, not yielding any juice, and consisting chiefly of simple nuclei, with more or less cellular tissue interspersed. The same is also generally the composition of the compound or mixed cystic growths in the neck. Fatty tumour may also occur congenitally.†

To these congenital tumours the observations above made will apply still more forcibly, viz. that they should be removed as soon as possible, if they are situated where their removal is unattended with danger. The operation may, however, be deferred, if the tumour be not in process of growth, until the infant has passed the period of the first dentition, or till the Surgeon judge that it has acquired sufficient power to bear the shock. But if the tumour be growing rapidly, no delay is admissible; and I have successfully removed a large tumour of this sort in the earliest period of life—at the age of fourteen days. The question of the treatment of the compound cystic growth in the neck will be found discussed in the essay on REGIONAL SURGERY.

Congenital or hereditary, and infantile syphilis. The poison of syphilis, when it has been conveyed into the constitution from an infecting sore,‡ saturates the blood, and vitiates, as it would appear, the composition of many of the secretions, and amongst others of the semen. From the blood, or from the semen, according as it is the mother or father who is the subject of the original disease, the foetus often becomes impregnated. This gives rise to a train of symptoms in the infant, which strikingly resemble, and strikingly differ from, those of secondary syphilis in the adult.

Before describing the symptoms of this disease in the infant, it is necessary to say a few words as to the origin of the disease, and as to the important and very difficult duties which its occurrence in a family lays upon the Surgeon.

That the children of healthy women may be born with the constitutional taint of syphilis is so common an observation, that the old idea of infantile syphilis being always, or very often, the result of direct inoculation from a sore existing in the vulva of the mother at the time of parturition, is contradicted by every-day experience, no less than by the character of the disease, in which a chancre is perhaps never, at any rate exceedingly rarely, met with. It is theoretically possible that the child might be so infected; but if that were ever the case, the disease would bear a much stronger resemblance to those unfortunate cases in which Surgeons contract syphilitic disease from inoculation of a crack on the finger, during the examination of a venereal sore, than to the ordinary congenital disease here referred to. Still the possibility of such a catastrophe renders it incumbent on a Surgeon, when delivering a woman who has a chancre in the vulva, to defend the infant as far as possible from contact with the secretions of the sore, by coagulating its surface with nitrate of silver and coating it with collodion.

Practically, however, the *congenital* disease, in the proper sense of that word, is always derived from the blood or semen of one or both parents. Therefore when an infant is born, in whom (by the symptoms which will be

* Mr. Cæsar Hawkins, *Med.-Chir. Trans.* vol. xxii. Gurlt, *Die Cystengeschwülste des Halses*, Berlin, 1855.

† As in a case related by Mr. A. Johnson, *Path. Soc. Trans.* vol. viii. pp. 16, 28.

‡ See the essay on SYPHILIS, vol. i.

shortly described) congenital syphilis is diagnosed, it is the duty of the medical attendant to discover which of the parents is affected, and not to allow (if possible) further cohabitation until the secondary symptoms have entirely disappeared, under the treatment which has been above described in the essay on SYPHILIS. Neglect of this precaution may not only entail on the couple the misery of a family of deformed, puny, and ailing children, but to the woman at least is fraught with grave personal danger. Whatever may be the case among the poor, there is no doubt that in the better classes congenital syphilis is usually derived from the father; the mother being uninfected except through the foetus. Now it has been, if not absolutely proved, at any rate rendered in the highest degree probable, that a healthy woman, carrying a syphilitic foetus, may become infected with constitutional or secondary syphilis, through the exchange of components which goes on between the foetal and maternal blood in the placenta. Thus are explained some of those cases in which women, who have never had primary syphilis, have shown all the symptoms of secondary syphilis after living for some years with husbands suffering from secondary symptoms.* There seems also some reason to believe that after such an infection of the sound parent, the disease in the future offspring will be rendered more intense. Otherwise the congenital disease appears to become gradually milder in each succeeding child, as the time of impregnation becomes more distant from that of the original infection of the parent, even apart from the influence of treatment on the latter. This, however, is by no means a reason for neglecting such treatment.

Again, children may be infected with syphilis in vaccination, or by contact with syphilitic sores on the persons of their wet-nurses or others. We shall recur to this, more strictly speaking, *infantile* variety of the disease, after having described the symptoms of that which is truly congenital.

Symptoms. The popular name for this disease—the snuffles—indicates one of its most striking features—a discharge which collects in the nose, blocking it up sometimes entirely, so that the infant is unable to suck for any length of time. In extreme cases, this inability to suck becomes a grave, and even dangerous, part of the disease. The nasal discharge is thought, with great probability, to be due to the presence on the mucous membrane of an eruption analogous to the cutaneous syphilide, which constitutes the principal manifestation of syphilis in the infant. This eruption differs from any of those seen in the adult, most probably in consequence of the different consistence of the skin in early infancy. The spots are usually somewhat coppery, but sometimes of a perfect rose colour, and more resemble roseola than any other of the ordinary eruptions; but the eruption is moister than roseola in the adult. On the soles of the feet and palms of the hands the cuticle usually scales off, and the eruption resembles psoriasis. On the other hand, where the cuticle is very thin, and kept moist by the folds of the skin or by discharges (as about the vulva and perinæum, near the anus and mouth, or in the groin), flat mucous tubercles are usually met with. Eruptions are also met with in the mouth in the form of white ulcers or patches, displaying the crescentic outline so common in various syphilitic affections of the skin. Together with these symptoms there is also observed, in nearly every case of congenital syphilis, a clear indication of the profound affection of the constitution, in the wizened and shrunken look, the anxious expression, and the dirty hue of the skin (a kind of dirty-greenish yellow), which imparts to the infant a peculiarly repulsive aspect of old age even at the threshold of life. There are other symptoms which are not so often seen. Thus various eruptions are spoken of as occurring in a later stage of the disease. In some severe cases the eruption rapidly runs on to ulceration, crusts cover the ulcers,

* Mr. Jonathan Hutchinson, in *Med. Times and Gazette*, vol. ii. 1856, and vol. i. 1857.

and a state resembling that of impetigo is produced. Papular and ecthymatous eruptions are spoken of, but they seem only slight variations of the ordinary skin-disease. Whether pemphigus in infants is often, or ever, due to syphilis is an undecided question. I have seen it in connexion, at any rate, with congenital syphilis, if not caused by it. The affections of the eyes, of the palate, and of the bones, which are so common in secondary syphilis of the adult, are so rare in children that it is doubtful whether the few cases which occur of disease in these organs in infants during syphilis may not be mere coincidences. I have seen each of these organs affected during the progress of congenital syphilis; but not exactly with the same kind of disease as prevails in the constitutional disease of adult life, *e. g.* the eye attacked with hypopyon and perforation of the cornea, but never with iritis;* large abscesses around the bones, but not nodes or chronic ulceration; sloughing of the soft palate, but not the excavating ulceration of the tonsils, or the caries of the hard palate so common in mature life. Finally, certain lesions or degenerations of the principal viscera have been pointed out as peculiar to congenital syphilis; but I cannot say that the evidence on this subject appears to me very conclusive; at any rate these lesions are of little moment in practice, inasmuch as no means exist of recognising them before death.

The period at which these symptoms make their appearance is a point of much importance in the prognosis of the disease. Congenital syphilis is a very frequent cause of the death of the foetus, and consequent miscarriage of the mother; that is to say, the foetus is affected at an early period of conception. In other instances the foetus is born alive, but with the characteristic snuffling and eruption; here the infection has not been matured till a late period of foetal life. In the majority of cases, however, which become the subjects of treatment, the infant is perfectly healthy, to all appearance, at birth; and the disease first shows itself after an interval, which is commonly about six weeks. As a general rule, the period of the appearance of the disease varies with its intensity; and this, again, varies with the length of time which has elapsed since the first infection of the parent, and depends also on the fact of one or both parents being diseased.

Besides the above congenital or hereditary disease, infants may be affected with syphilis, as adults also may, by various methods of contact and of inoculation. That primary syphilis is communicated by actual contact to any part of the body where an abrasion exists, or even (as it seems) where the cuticle is very delicate without abrasion, is a fact of as much importance in the infant as the adult; and it has been conceded above that possibly syphilis may in some rare cases be so communicated in the act of parturition, and it may also be accidentally inoculated in infancy, as at any period in life, if the patient is brought into direct contact with another affected with primary syphilis, as when a nurse is suffering from primary syphilis. Secondary syphilis, it seems now agreed, may also be inoculated;† and this is even more likely to occur to infants than adults, on account of the constant contact in which they are held to the bodies of those who nurse them, the frequency of slight pustules and abrasions on their bodies, and the thinness and moisture of their skins. This second source of acquired syphilis in infants is verified by many recorded cases.‡ But a third source—and one which, on account of its bearing on public health and public policy, is perhaps even more important—is that inoculation of the vaccine virus, which a wise legislation is now seeking to make generally com-

* Mr. Lawrence, however, speaks in his *Lectures on Surgery*, 1863, of iritis as a common symptom in infantile syphilis. Having had numerous opportunities of seeing the complaint among the out-patients of St. George's and the Hospital for Sick Children, I cannot remember ever seeing a genuine case of iritis, nor does it occur in the elaborate enumeration of the symptoms of this disease in Diday's work.

† Lee, *Lectures on Syphilitic Inoculations*, 1863, pp. 239 et sqq.

‡ *E. g.* the celebrated case of Chiabrera, the source of the late vaccino-syphilitic eruption at Rivalta, *ibid.* pp. 130 et sqq.

pulsory in infancy. There seems no possibility of denying the fact, certified as it is by the evidence of many competent medical observers and by the reports of authoritative public commissions, that in a thinly-inhabited country district of Piedmont, in the year 1861, where syphilis, if not unknown, was at any rate so rare that the medical men in the neighbourhood had no opportunities of seeing it, forty-six children, of various ages, were simultaneously attacked with well-marked syphilis, proceeding, in all the cases which could be properly examined, from chancres on the arm, followed by buboes in the axilla; and that all these children had been vaccinated, directly or indirectly, from a single child, who was subsequently proved to have contracted syphilis from a wet-nurse; and further, that these children transmitted the same disease to a number of women, their wet-nurses, mothers, &c., and even to children who nursed and played with them; that the women so infected in turn infected their husbands; and finally, that the disease yielded in all cases to the usual remedies for syphilis. This is by far the most convincing instance of the propagation of syphilis by vaccination; but it is by no means the only one, as may be seen by consulting Mr. Lee's work above referred to. Nay, an experiment is related there,* which, if it is to be relied on, would show that a healthy person can be inoculated with constitutional syphilis by blood drawn from a vein, lying under a sound part of the skin, in a person labouring under that disease. From facts such as these, combined with details of the vaccination performed from the syphilitic infant who was the source of the whole outbreak at Rivalta, and which tend to show that blood was mixed with the lymph introduced, Mr. Lee concludes that the blood, accidentally drawn in vaccinating from this syphilitic child, was the source of the infection; and that to guard against a repetition of such a catastrophe it is sufficient, 1. that a clean lancet should be used; 2. that the lymph should be taken from the vesicles not later than the eighth day; 3. that lymph only should be taken, and that it should be free from the admixture of blood or of other secretions; 4. that the lymph should be taken from a healthy subject. It is greatly to be hoped that these precautions may prove sufficient; and we are encouraged to believe that they may, from the extreme rarity and dubiousness of the occurrence of syphilitic infection after vaccination in this country, as well as from the account of the outbreak in Italy, which shows that it is highly probable† that the vaccinator had neglected Mr. Lee's fourth caution; and that if he had carefully examined the infant who was the source of all this mischief, he would have found evidences of existing syphilis.

It will be observed, however, that this *infantile* disease, contracted by contact or inoculation, differs in no respect from the usual forms of primary syphilis, except in the seat of the original chancre, and therefore no more need be said about it here. The importance, however, of knowing, and acting upon, the fact that infants may be infected in this manner, and may then become the sources of contagion to their previously healthy parents or attendants, rendered it necessary to notice the subject.

There are other sources from which an infant may be infected with syphilis while at the breast. It appears to have been now put beyond doubt that the lesions of secondary, as well as those of primary, syphilis are capable of producing the infecting chancre.‡ We may conclude from the facts of every-day experience, that such secondary lesions are not sufficiently contagious to convey the disease, except after prolonged and intimate contact, and to a part where the cuticle is either abraded or very delicate; but there are facts which appear to prove that infants (in whom both these conditions meet together) do occasionally contract primary syphilis by contact with

* Op. cit. p. 198, the case of Dr. Bargioni.

† See op. cit. pp. 183, 184.

‡ On this subject see Rollet, *Recherches cliniques et experimentales sur la Syphilis*, and H. Lee, op. cit.

persons affected with primary or secondary sores. This occurs most usually where they are suckled by women labouring under syphilis (particularly when the syphilitic lesions affect the nipple or mamma), and the part infected is usually the mouth. When, therefore, a child at the breast of a wet-nurse shows symptoms of secondary syphilis some weeks after birth, it will be proper to examine carefully and see whether such symptoms resemble the truly hereditary form of the disease described above, or whether they do not follow on the occurrence of a chancre on the lip, attended by enlarged submaxillary glands. These cases occupy more space in foreign works, probably because wet-nursing is more common abroad than in England; and it appears very usual for wet-nurses to be infected in the nipple by suckling syphilitic infants. In such a condition it is easy to imagine that they might give suck to their own or other uninfected infants, and so a chancre be produced.* Nor are cases wanting in which children have been said to be infected in other ways and in other parts of the body.† But in all these cases the disease, though differing in its seat and alleged exciting cause from ordinary syphilis, differs from it in no other respect; and an attentive examination will usually clear up all difficulties even at some distance of time from the first appearance of the chancre. The treatment must be the same as for ordinary infecting chancre or its sequelæ.

It is perhaps hardly necessary for me to do more than allude in the most cursory manner to the case in which the infant infects the nurse. I have never seen an instance in which this has occurred when the mother has been the nurse, although she might be quite free from any trace of present or past syphilis; but it is impossible to doubt that when suckled by healthy wet-nurses syphilitic infants have often proved the source of contagion. The chancre appears on the areola of the nipple, is accompanied by indurated glands in the axilla, and is followed by alopecia, sore-throat, and syphilitic eruptions. Cases of the conveyance of the disease to the husband from women so infected are given by foreign authors; but are to be received as true only after the most rigorous examination—if indeed any examination can entirely justify the assumption.

Diagnosis. The diagnosis of syphilis in children, whether hereditary or acquired, does not usually present much difficulty. The snuffles, eruption, and peculiar cachexia of the congenital disease, together with its persistence, are usually sufficient to characterise the complaint even when its history is concealed or unknown. Non-syphilitic roseolous, or other, eruptions might no doubt occur together with coryza; but such eruptions (and still more the ordinary strophulous affection) yield readily to simple treatment. In a few doubtful cases I have found the child's general condition improve so rapidly under the influence of mercury, that I have no doubt of the propriety of administering that drug when we have good reason for suspicion, but cannot form an absolutely certain diagnosis. In the acquired disease, if seen in an early stage, the appearance of the sores, the enlarged glands which are generally connected with them, and the examination of the mother, nurse, or attendant, will usually clear up the diagnosis. Later on, the eruptions, alopecia, and affections of other organs, must be diagnosed by the same rules as secondary syphilis in the adult; but as the disease is so much rarer in children, more caution will be necessary. The inoculation of syphilis by vaccination has, happily, been almost unknown in this country, and I have never seen a well-marked case. In an infant under Mr. Lee's care, whom I had an opportunity of seeing a short time since, indolent ulcers, with some hardening of the base, and an enlarged gland in the armpit, remained several weeks after vaccination; but the symptoms were not sufficiently marked to justify a positive diagnosis. I

* Rollet, op. cit. pp. 256, 263.

† Thus some of the children who nursed the babies infected by vaccination at Rivalta had sores and suspicious eruptions on their arms and other parts.

have been informed that such phenomena have been noticed before as occasionally following vaccination, but without evidence of constitutional syphilis. The points to which attention should be directed in forming the diagnosis are, the state of health of the child from whom the lymph was obtained—if that can be ascertained—the appearance and secretion of the sores, the character of the bubo, and the presence of secondary symptoms after three or four months.*

Prognosis. The prognosis of hereditary syphilis is usually represented as very favourable, if only the disease be early treated. I must say, however, that I have seen a good number of syphilitic children die; few indeed from the direct results of the disease, but many from intercurrent infantile disorders of various kinds. In fact, congenital syphilis is a profound cachexia, which renders children far less able to resist any of the numerous febrile disorders to which (especially among the lower classes) they are so much exposed. With this reservation, the prognosis is good for ordinary cases; but those in whom the disease has commenced before birth, and who are extremely stunted and withered, will very probably die, more especially if the nose is so much obstructed as to render sucking difficult.

Treatment. The only treatment which is at all justifiable in congenital syphilis is the administration of mercury; and the only question therefore is as to the most advantageous way of administering that drug. The method recommended by Sir B. Brodie of inunction is quite sufficient: this is managed by merely keeping a flannel band, smeared with ung. hydrarg. twice a-day, constantly applied to the thigh or the arm for about six weeks. This is the most convenient plan in private practice, or where the Surgeon can make sure that his directions are implicitly followed; but in hospital practice I have found it more safe to give the drug in the form of medicine—a plan in which the ignorant have more confidence; a grain and a half or two grains of gray powder, with a little of the compound chalk-powder to prevent irritation, may be given night and morning. The calomel vapour-bath may be used, if the parent or nurse is also infected. Whatever be the form selected, the course should be carried on for full six weeks, by which time the eruption will most probably have disappeared, and the child have regained its plumpness and healthy complexion. If not, the mercury should be continued until the cure is complete.

The local treatment is of subordinate importance. The coryza may be alleviated by syringing out the nostrils either with water or some astringent lotion, a drop or two of sweet-oil being afterwards introduced; ulcerations about the genitals may be touched with solutions of caustic or sulphate of copper; and the ordinary applications may be used to sores in other parts. But these measures have little real value beyond their cleansing efficacy. With a sufficient course of mercury, simple cleanliness is usually all that is necessary; without it no local applications do much good.

The remoter effects of congenital syphilis are either direct or indirect. As the ordinary congenital disease bears a considerable resemblance to the secondary symptoms in adults, so there are seen, although only rarely, phenomena analogous to the ordinary tertiary symptoms. The researches of Mr. Hutchinson on interstitial keratitis, and on the deafness which appears to be sometimes a consequence of congenital syphilis, are well known, and have been alluded to above.† Another remote consequence of congenital

* It would be a question for the Surgeon himself to determine whether he would think it justifiable in the case of a doubtful sore after vaccination to test its inoculability on another part of the child's body. If the Surgeon held, with Mr. Lee and others of the best observers, that an inoculable sore is a soft sore, and therefore non-infecting, and therefore not requiring specific treatment, no practical advantage could result from the experiment.

† See DISEASES OF THE EYE, vol. ii. p. 711; DISEASES OF THE EAR, vol. iii. p. 185.

syphilis which Mr. Hutchinson has pointed out, is the condition of the permanent teeth,* the central pair of incisors in the upper jaw presenting the peculiarities of being generally ill-developed, usually small in size and therefore separated from each other, of soft consistence, and marked at a short distance from their free edge by a crescentic notch from which one or more tubercles project, so that the edge of the tooth is notched, lobulated, or irregular. These tubercles soon wear off in consequence of the softness of the teeth, leaving the edge of the tooth crescentic. Syphilitic teeth are also very liable to caries; but the irregularities here spoken of, exist in those which are not carious, and are far better observed in such. The same or similar peculiarities may be presented by the outer incisors of the upper jaw, by the lower incisors, and by the canine teeth; but they are less marked, and are not relied upon as diagnostic by Mr. Hutchinson. Both his papers are well worth reading, and his views have been supported by experience hitherto; although the whole question is so difficult on account of the length of time which has elapsed between the supposed cause and its observed results, and also on account of the nature of the disease, that it is very hard in many cases to say whether they tend to support Mr. Hutchinson's views or not.† It is certainly important, in a diagnostic point of view, to be familiar with this alleged syphilitic condition of the central permanent incisors; not to confound it with the numerous other irregularities to which the teeth are liable from hereditary or personal peculiarity, from disease and from neglect; and I may be allowed to add, not to forget that Mr. Hutchinson's doctrine is not intended to apply to the temporary teeth: these, although they may of course be diseased in syphilitic children, do not show any diagnostic peculiarities.

Finally, there are some other tertiary symptoms which are occasionally seen connected with old attacks of hereditary syphilis, but so rarely that the nature of the connexion can hardly yet be said to be settled. Thus I have spoken in the note of a case in which destructive ulceration of the soft palate took place in connexion with many of the symptoms of congenital syphilis; in another case I have seen laryngitis, requiring tracheotomy, in connexion with interstitial keratitis, total deafness (acquired), and lupus exedens. And in connexion with the latter disease (which appears to be, though rarely, a symptom of the later stages of syphilis in adults, especially in hot climates), I may say that I am informed by my friend Mr. Nayler that he has seen a case of vaccino-syphilis where the whole arm was covered by a copious eruption of well-marked lupus. That some of the diseases of the bones so common in weakly children may be due to tertiary congenital syphilis is probable, but I think is not yet proved.

The treatment of these later stages of syphilis is pretty nearly identical in children and in adults.

Infantile paralysis. One of the most lamentable, and often, unfortunately, one of the most incurable, affections of infancy is that form of paralysis which is called "infantile" or "essential" paralysis, and which differs from the forms of palsy which are described in other parts of this work, as well as from those which are the more proper objects of medical treatment, in the important fact that the palsy is not a symptom of any known disease (as is

* *Path. Soc. Trans.* vol. ix. p. 449, vol. x. p. 287.

† For instance, I had a short time since a patient aged about twelve, in whom the condition of the teeth and of the corneæ was strongly indicative of congenital syphilis; he had also lost the soft palate from ulceration: and the very striking improvement which followed the use of iodide of potassium alone, with no other medicine either local or general, strongly supported my first impression that the case was one of tertiary congenital syphilis. Yet I could obtain no account of the original disease; and the occurrence of syphilis in either parent was denied, and with all apparent sincerity.

the case in the progressive atrophy of muscles which is described in the essay on DISEASES OF THE MUSCULAR SYSTEM), nor is occasioned by any lesion of the nervous centres or (as far as we know) of the nerves themselves; but is the essence of the disease.

The palsy, or loss of motion, affects single muscles in some rare cases,* but more usually whole limbs (generally the lower), and often the whole of one side of the body. It may even attack both lower limbs, though this is very rare.

This strange affection raises many questions of interest with respect to its causes, its pathology, its diagnosis, and its treatment; as to none of which does it appear that very confident answers can at present be given. In the first place, as to the causes of the essential paralysis of infancy. These can rarely be discovered. In some few cases the affection has followed immediately on exposure to cold, and has affected only the part exposed, as paralysis of one leg after long sitting on a damp stone;† but in the great majority of instances, no hint is obtained from the history of the disease, except that, as most cases come on during the period of the first dentition,‡ there is a vague habit of referring the disease to "dental irritation." But of the real existence of this irritation there is usually no proof, still less of its having had any influence on the nervous centres. Convulsions sometimes accompany the onset of the disease; but they can hardly be regarded as connected with it as a cause, since the form of paralysis we are here speaking of is quite distinct from that which is caused by disease of the brain.

The causes of the disease being unknown, it is not wonderful that its pathology should be so too. It is regarded with much plausibility by some authors as an affection of the nerves; but against this view is to be placed the fact that the palsy does not always (I believe, not often) correspond in extent to the anatomical distribution of the nerves; and that although the nerve apparently affected may supply both muscular power and sensation, the palsy hardly ever affects the latter function, and if it does, the loss (or what is more common, the exaltation) of sensibility is general over the whole limb. Dissection has hitherto thrown no light on the matter. The muscles are of course atrophied from disuse; but neither in the spinal cord nor in the nerves has any thing been found to account for the symptoms.

Symptoms and diagnosis. The diagnosis of the disease can usually be made with accuracy; but some cases will be left, in which it is not easy to separate essential from symptomatic paralysis. The history of a case of infantile paralysis is usually this: The child has been, as far as it was noticed, in its usual health, or perhaps may have had a feverish ailment of some kind, which has left it weak; when, either suddenly or gradually, it loses the power of motion to a greater or less degree. A slight feverish attack may accompany the commencement of the disease, and during this attack there may be convulsions. The loss of power will always be found at first to be partial, and in some fortunate cases is transitory,—the affected muscles regaining their strength as rapidly as they lost it,—but in the greater number the palsy increases, till the part can be hardly, if at all, moved. To this second stage of the disease, which may last an indefinite time, succeeds one in which deformities are produced by the action of the unparalysed muscles, in those cases where the palsy affects (as it often does) only one side of a limb. Thus the heel is often drawn up by the unbalanced action of the tendo Achillis, producing club-foot, or the toes are drawn into the sole of the foot, the knees flexed

* I have had two or three cases under my own care, in which the deltoid was the only muscle affected. Sir B. Brodie related a case to Mr. Adams, in which he believed the muscles of deglutition were paralysed. Is it possible that this was diphtheritic?

† West's *Lectures on the Diseases of Infancy and Childhood*, 4th ed. p. 219.

‡ Out of 32 cases noted by Dr. West, the disease began in 19 between the ages of eight months and three years.

by the hamstring muscles; and I have known a case where the thighs were drawn together by the rigidity of the adductor tendons.* During this last stage of the disease the palsy may have more or less subsided in the muscles originally affected.

In each of the stages of the disease, the careful study of the symptoms will usually enable a Surgeon to pronounce a correct opinion. In the first stage,—that of incipient paralysis,—the great point is to distinguish the disease from inflammatory affections of the brain, and from disease of the spinal column. In most cases there is little difficulty, since in the infantile paralysis the loss of power is usually limited to a few muscles, and not complete even in these; while in that which is due to organic lesions of the nervous centres the palsy is usually extensive and complete. To this it may be added that the causes of cerebral paralysis in childhood—as meningitis, hydrocephalus, tubercle of the brain—have their own appropriate symptoms, which must be sought for with care, and will be found wanting in the essential paralysis. I have never seen a case which it was possible to confound with spinal paralysis; and should suppose that a moderate amount of care would always suffice to prove the absence of any spinal affection.†

In the stage of confirmed paralysis and atrophy the chief point is to distinguish the disease from joint-disease and from progressive muscular atrophy, as well as from the affections of the brain and spine. The latter is usually easy at this stage. As to joint-affections, the question occurs chiefly in the shoulder and hip. In the shoulder there is little difficulty. The arm affected by essential paralysis of the deltoid is relaxed in all the parts around the joint, and the head of the humerus hangs down at some distance from the glenoid cavity, partially dislocated by the weight of the arm itself. There is no pain or difficulty on passive motion. The hip-joint is less easily under observation, and the morbid sensibility which accompanies some of these cases of paralysis gives more resemblance to hip-disease on first handling the limb; but the distinction is usually easy to make. Paralysis affects a great part or the whole of the lower limb; hip-disease only causes loss of movement of the part affected: in the former passive motion is easy and causes no pain, or not more than any other motion; in the latter the joint is stiff, and an attempt to move it causes acute suffering, not occasioned by any other movement: finally, in paralysis there is no wasting of the buttock, unless the whole limb is wasted, nor is the position of the trochanter ever altered. From progressive muscular atrophy, or “wasting palsy,”‡ the rare occurrence of that disease in infancy, and its progressive advance, will suffice to distinguish it. In its latest stage, of contraction and deformity, the disease is sufficiently marked.

Treatment. Infantile paralysis, then, consists in a sudden or gradual loss of power in certain parts, unaccompanied by any inflammation, or by any symptom of disease of the brain or spinal cord. The main consideration in its treatment is the natural progress of the disease. Some authors take a more sanguine view of this subject, and say that there is a natural tendency to cure;§ but this seems to me to apply only to milder cases of the disease. In such cases the palsy is often transient, and the usual remedies for any disorder of the health which may be present will get the credit of having cured it; but in confirmed cases (that is when total inability to use any muscle or set of

* West, op. cit. p. 228.

† I should perhaps mention that cases are recorded in which an enlarged gland or tumour has pressed on a nerve, and caused palsy of the parts supplied by it. In cases of localised palsy, therefore, the course of the great nerves of the part should be examined.

‡ This name is given to it in a treatise by Dr. Roberts, of Manchester, which the reader will do well to consult. The disease in question is described in the essay on DISEASES OF THE MUSCULAR SYSTEM, vol. iii. p. 529.

§ See a paper by Dr. Bierbaum in *Journ. f. Kinderkrankheiten*, vol. xxxii.

muscles has lasted for several weeks), I cannot say that I have seen much benefit from treatment. In the early stage, while there is some feverish affection, and perhaps a tendency to convulsion, antiphlogistic remedies may be employed, such as purgatives, and the continuous use of mercury.* But the internal indications usually point to the use of tonics, among which Dr. West speaks well of strychnia. He says, "I have never yet given it to infants; but with children of four years old I begin with an eighth of a grain of the spirituous extract of nux vomica three times a day, increasing the dose by degrees to a sixth, a quarter, or a third."† When all disturbance of the general health is over, but the paralysis persists, local measures afford more hope of cure than general treatment, viz. passive and active movements, stimulating applications, and galvanism. The palsied limbs should be well rubbed and gently shampooed twice a day; the child should be encouraged, coaxed, and if possible forced to use them (for the palsy is not often complete); for which purpose any games that it can be got to take pleasure in, or a baby-jumper, or a go-cart, will be found useful. The linimentum cantharidis has often seemed to me to be of service; and galvanism, if carefully and scientifically used, certainly does good in some cases, though it often fails in others apparently quite similar. In the final stage of the disease, when deformity has been produced by the uncontrolled action of the unaffected muscles, much good may be done by tenotomy and carefully contrived apparatus. Very often it will be found that the child who has previously been doubled up, and whose limbs have all been rendered useless, can in this way be put quite straight, and enabled to stand with the assistance of supports, and even to walk a little with the help of assistants; but I have not hitherto seen a case of confirmed palsy in which any greater improvement than this was obtained, though I have continued patient treatment by all known methods for many months.

Gangrene. Cases every now and then occur in which gangrene comes on with frightful rapidity, and without any obvious cause, in children—usually those who are debilitated by some previous febrile ailment. Such a case took place some years ago at the Hospital for Sick Children, in the person of a little boy who was convalescent from measles, and about to be discharged. He had made no complaint of any sort, but the nurse in undressing him found both feet black in patches. Three hours before, his stockings had been put on, and the feet were then natural. The child was examined; the case found to be really one of gangrene, and the patient of course put to bed. The gangrene extended with great rapidity, reaching as high as mid leg next day, when he died. There were also patches of gangrene on the elbow and hand. No cause was discovered, on post-mortem examination, to account for this rapid invasion of gangrene.‡ Such cases are of course very rare; but in two situations gangrene is very common in childhood, viz. in the face, *cancerum oris*; and on the vulva, *noma vulvæ*. The former affection has been already described, having been used in the essay on GANGRENE, vol. i. p. 77, as an illustration of one of its spontaneous forms. The latter form of gangrene is very frequently seen in children's hospitals, though I cannot recall any instance of its spontaneous development in hospital; and from this circumstance, as well as others in its history,—viz. the aspect of the children; the rarity, to say the least, of its occurrence amongst the children of the upper classes; and the success attending its treatment,—it seems pretty certain that it is the direct

* Gross says, "Mercury has been strongly recommended in this disease, given in minute doses several times a day, for several successive months: but although such a plan of treatment is extremely plausible, I cannot say that I have ever derived any benefit from it, in a large number of cases in which I have employed it." *System of Surgery*, 1st ed. vol. i. p. 796.

† Op. cit. p. 229.

‡ *British Medical Journal*, 1857, p. 387.

consequence of bad food and inattention, more particularly if the child has been previously ill: but cases often occur in children who have had no known illness. The first symptom noticed is usually a dusky colour of the skin of the labia, and foul discharge, with pain in micturition. The parts swell, and soon assume a gangrenous colour, the slough being bounded by a halo of inflammation extending to the groins. At the same time there is much depression, loss of appetite, and occasionally vomiting. The treatment consists in stopping the extension of the gangrene, supporting the strength, and regulating the condition of the bowels. For the first purpose nothing seems so appropriate and so successful as the application of the strongest nitric acid. This caustic is peculiarly successful in the gangrene of children in all its forms. Sloughing phagedæna in adults often proceeds unchecked after the application of the acid; but in all the cases (which certainly have not been many) that I have seen of its application for sloughing phagedæna in childhood, the gangrene has been at once checked. So also in cancrum oris. Whenever the extent of the disease has been such that it has been possible to steep the whole gangrenous surface in the acid, the disease has been checked. Noma pudendi is not less, in fact it seems to be more, under the influence of this remedy; and there are few cases which will resist its timely and thorough application, if conjoined with the proper measures of general support; but the application must be both thorough and timely. As soon as the disease has declared itself, or as soon as the child is brought under treatment, chloroform is to be administered, the parts well separated by an assistant, and the whole of the sloughing surface freely steeped in the acid. Next day, should any part appear to have escaped the application, or should the gangrene be spreading in any part, that part should be again freely cauterised in the same way. Some Surgeons prefer the actual cautery; but I have found the nitric acid so successful, that hitherto I have had no experience of any other caustic. After the cauterisation, a poultice should be applied to hasten the separation of the slough, and a lotion of carbolic acid may be poured into, or placed around, the poultice to correct the fœtor. A purge may be given at first, if the tongue is foul, and bark with chlorate of potash, or with ammonia, or some other diffusible stimulant, given in as large doses as can be borne—wine and food being allowed as freely as the child will take it. In cases where the general strength is not extremely depressed, and where this treatment is adopted early, it is almost uniformly successful; but in the opposite circumstances, even though the gangrene may be stopped, the child, without any obvious symptoms, will sink and die. No post-mortem appearances are found in such cases. After recovery there appears to be little deformity; but I have had no opportunity of seeing whether any trace of the ravages of this disease persists in after life.

Infantile leucorrhœa. The vagina in children also sympathises in the child's general condition in another way, which very often falls under the Surgeon's notice. This disease occurs as a copious discharge of a purulent or muco-purulent fluid, much resembling the discharge of gonorrhœa, and usually supposed by the child's mother to be the result of impure connexion. In the great majority of cases no such connexion has occurred, and the suspicion ought to be dispelled from the minds of the parents, as it frequently gives rise to unfounded charges. But in a few cases there is no doubt that a criminal assault has been the source of the disease. No diagnosis, as far as I am aware, can be made between the ordinary infantile leucorrhœa and a gonorrhœal discharge which has been caused by connexion unaccompanied by violence,* except in some very rare instances in which, the child having been seen very soon after the occurrence, spermatozoa have been detected in the vagina.† But if any

* Mr. Cooper Forster gives a curious case, in which a woman communicated gonorrhœa to two girls by washing them with her own sponge, op. cit. p. 125.

† This occurred in a case at King's College Hospital, a short time ago.

force has been used, either to compel the child to submit, or in order to effect penetration, the marks of bruising or laceration will prove valuable evidence. The common leucorrhœa comes on with some inflammation of the parts, causing a good deal of itching and complaint in passing water. The labia are swollen and red, and often more or less excoriated. The discharge soon sinks into a chronic condition, and may remain so for an indefinite time. The general health is usually more or less feeble, and the child often suffers from worms. Attention to the state of the general health and of the bowels, fresh air, chalybeates, scrupulous cleanliness, and the liberal use of astringent injections, will usually cure the complaint; but it is often slow in subsiding. Care must be taken in injecting to use a small syringe, and do no violence to the parts; and it is advisable to dry the vulva well afterwards, and smear some oil or lard over it to obviate the contact of the discharge. If the disease be known or suspected to be gonorrhœal, little variation need be made in the treatment; except perhaps that, as the complaint will commence with more acute symptoms, poppy fomentation may be used for the first few days, and the child kept to bed.

Tumours of the vagina. The vagina is in some rare cases the seat of soft tumours, which, if not congenital, are rapidly developed in very early life. A female infant was under Mr. Athol Johnson's care some years ago, at the Hospital for Sick Children, in whom a bleeding warty growth existed inside the labia, looking somewhat like ulcerating condyloma, but with no syphilitic history. It had been treated by a course of mercury for some months at another hospital, as syphilitic, but got worse. The application of the acid nitrate of mercury effected a cure. In another case under my care the vagina was filled with a large mass of semi-solid matter mixed with cysts, looking something like a bunch of grapes. I pulled away as much as I could, and applied a caustic to the base of the tumour; but whether with permanent success I do not know, as the child was removed from the hospital by her mother. Such tumours may be excised if their attachments render it possible; but even then the free hæmorrhage that would be produced is undesirable in infancy. In the case just described it would have been impossible to cut away the tumour, in consequence of the small size of the vagina and the depth from which the mass protruded. Probably caustics would be in all cases the best, and of these the acids or the electric cautery would be the most manageable.

Rickets is a disease peculiar to childhood; for though the effects of rickets are perceptible in the deformity which it produces throughout the whole of life, yet all active symptoms always subside long before puberty. The softening of the bones, which occurs in later life, and to which the name of *mollities ossium* has been given, is to be distinguished from the infantile malady.*

The term "*rickets*" has reference to the distorted condition of the bones, especially those of the limbs, which is the most striking feature of the disease.† This, however, is only a symptom of the constitutional cachexia which is the essence of the complaint. As in syphilitic, cancerous, and scrofulous affections of the bones, so in rickets, the local condition is only the expression, as it were, of a latent and undetermined tendency in the whole organism,

* See *Mollities ossium*, in *DISEASES OF THE BONES*, vol. iii. p. 667.

† The term "*rachitis*" was originated by a committee of the College of Physicians (one of whom was Glisson), about 1645. "One of us," says Glisson, "in searching for a name, hit upon that of *rachitis*, which took our fancy immediately." Glisson remarks that the disease which they christened "*rachitis*" was vulgarly known by the name of "*rickets*" (hence it follows apparently that the latter term is not derived from the former). Can "*rickets*" be derived from the old French word *riquet*, which is the same as *bossu*? Some have supposed both "*rickets*" and "*riquet*" to come from the German *Rücken*.

which, as in the diseases referred to, attacks other parts as well as the bones. But, unlike those diseases, the affection of the bones is in most cases of rickets a matter of far greater practical importance than that of the remoter parts. Accordingly, in the short sketch which my space will allow, I shall dwell more on the local than the constitutional features of rickets. Those who desire to obtain a more adequate view of this important subject may consult the valuable lectures of Dr. Jenner, in the *Medical Times and Gazette*, vol. i., 1860.

The chief symptoms of rickets are as follows: The ends of the long bones and those of the ribs, where they join on to the epiphyses or the costal cartilages, are noticed to become swollen and knobby. This enlargement is particularly perceptible in the carpal ends of the radius and ulna. Soon the limbs become weak, so that sometimes, if the child have begun to walk, it is "taken off its feet;" or else the power of walking is not attained at the usual time; in other cases the child continues to walk, but at the expense of increasing deformity of the extremities, producing bow-legs, and of the spine, causing one of the species of curvature. This deformity is a consequence of a peculiar process of softening which goes on in the shafts of the bones. The morbid anatomy of rickety bones has been described with great minuteness by the German anatomists, and in our own language in the excellent lectures of Dr. Jenner. It will be sufficient here to say that the chief changes are a large production of growing tissue at the epiphysal ends, a softening of the bony tissue of the shafts, attended with enlargement of the lacunæ, which are occupied by a red pulpy substance, and a great thickening of the periosteum.* In the flat bones, especially those of the cranium, this thickening of the periosteum and enlargement of the lacunar tissue causes a considerable increase in the thickness of the whole bone, to which is partly, at any rate, due the large size of the head generally noticed in rickety children. The softening of the bones soon reaches such a degree, that the bones bend under the influence of external force and of muscular movement. The extent to which each of these mechanical causes influences the curvature of the limbs, of the chest, and of the spine, is a matter of much interest, and of some importance in practice. As to curvatures of the spine and as to pigeon-breast, the reader will find all that is necessary in the section by Mr. Shaw on those subjects. Rickety curvature of the limbs is, no doubt, produced by both causes. Where powerful muscles (as the deltoid) are inserted at an advantageous angle into the shafts of the long bones, deformity is generally very marked in advanced rickets; while on the other hand the deformity is as marked in situations, such as the forearm and the tibia, where no adequate muscular force can have been acting on the bone, and where the curve is obviously due to the weight supported by the hand in crawling in the first instance, and by the legs in walking in the second. The softened bones are also peculiarly liable to fracture from slight causes. These fractures are very frequently unaccompanied by laceration of the periosteum, on account of the slight force that has produced them, and the thickened condition of the latter membrane, and are often of the incomplete or "greenstick" variety. The fragments in many cases are kept in apposition by the thickened periosteum; hence, when the disease is not in a very acute stage, rickety fractures generally unite kindly. Slight causes, however, soon reproduce them; so that rickety children sometimes present almost as miserable (though by no means so hopeless) a condition as adults affected by mollities. The softened condition of the bones also induces deformities of the walls of the great cavities of the body, which have a very material influence on the viscera contained in them. Mr. Shaw's essay will point out the great influence which an insufficient expansion of the chest in infancy has upon the shape of its walls, by exposing the bones to atmospheric pressure. Much more powerfully will this force act when the

* See Dr. Merei, *Disorders of Infantile Development*, p. 157.

bones are softened even beyond what is natural in infancy. Hence one of the causes of deformity of the chest in rickets may be conceded to be the pressure of the atmosphere upon the softened bones, induced by incomplete expansion of the chest, the result of laryngismus stridulus, or of collapse of the lung-tissue—common affections in weakly children. A second cause is the outward pressure on the lower ribs, caused by enlargement of the liver and spleen often present in these cases; and a third (which seems rather theoretically probable than absolutely proved) is the inward traction upon the cartilaginous extremities of the ribs by the attachments of the diaphragm. The result is a constriction of the chest, much as though a string had been tied tight round it below the heart, whilst its apex is distended. Except in very severe cases, this deformity of the chest may be expected to be effaced as the child recovers from the constitutional taint.

The pelvis is often the seat of deformity, whereby its outlet is much narrowed, the tuberosities of the ischia being pressed towards each other, and the pubic arch widened; or else the face of the pelvis is pressed backwards towards its posterior wall, the tuberosities of the ischia are thrust outwards, and the pubic arch widened.* In some cases, again, the whole pelvis is said to retain the small size and imperfect development of infancy. Any of these deformities will of course oppose a serious, and perhaps insuperable, obstacle to parturition in after life; and the change of shape of the outlet is often a source of embarrassment in lithotomy in children. This embarrassment, however, seldom proves serious; but a case is on record in which the operator was obliged to abandon the attempt to reach the bladder on this account, although a renewed attempt was more successful.†

The existence of a constitutional cachexia is proved in some cases by an interval of languor and general ill-health preceding the appearance of any disease in the bones; but very generally the latter symptoms are the first which attract attention. The disease commonly begins before the age of two years, although often earlier, and even in intra-uterine life, forming one of the causes of congenital fracture. The child, if it has been able to walk, loses that power: if it has not, it does not make the usual efforts to "find its feet." It loses the activity both of mind and body which is natural to early life, and its muscular strength diminishes. Enlargement of the ends of the long bones where the shaft joins the epiphysis, and of the ribs where they join their cartilages, is early noticed; and soon the fact of the bones being softened is proved by their yielding to mechanical force, and becoming distorted. The enlargement of the joint-ends is most perceptible at the wrist and ankle, especially the former, on account of the superficial position of the bones; and therefore the swollen state of the ends of the radius and ulna, together with that of the ribs, is the familiar test of the existence of the disease; but dissection proves that the same condition exists in the deeper-seated bones. It must not be forgotten that a slight enlargement at this part of the bones is natural in very early life.

There are some other symptoms which, although they are not essentials of the disease, nor can be relied on to diagnose it in the absence of the affection of the bones, yet are very constantly met with in rickets. These are retarded dentition, retarded closure of the fontanelle, enlargement of the head, sweating of the scalp, and a tendency to throw off the bedclothes at night. Muscular weakness is also generally a prominent symptom, even beyond what the softened condition of the skeleton would account for. The assemblage of such symptoms would lead to the suspicion of impending or commencing rickets, and in consequence to prophylactic treatment founded on such suspicion; but the enlargement of the ends of the bones with softening of their shafts is the only diagnostic mark of the actual presence of the disease. Reference must again be made to the following section, by Mr. Shaw

* Humphry, *on the Skeleton*, p. 447.

† H. Thompson, in *Med.-Chir. Proc.* Nov. 24, 1863.

p. 853), for a description of the arrest of growth and development connected with rickets.

Rickets, in milder and ordinary cases certainly, and in all cases probably, ends to a natural cure. The deformed bones become consolidated, and remain, during life, in the shape which they have thus been caused to assume. They are then thicker and heavier than the natural bones.* The stature is thus diminished; but the constitutional vigour and the muscular strength is soon recovered when the cachexia has passed away, and the child, though small, is strong and sturdy. There are cases, however, in which the viscera of the chest have suffered from the pressure of the softened bones, or in which the child's life is endangered by collapse of the lung, or laryngismus stridulus, affections which the softening of the parietes of the chest makes doubly dangerous. From these causes many rickety children die.

The diagnosis of rickets is generally easy. The swellings of the joint-ends of the bones and of the bony ends of the ribs, the constriction around the chest, the bent limbs, the large abdomen, the large head and small face, the habit that the child displays of tossing off the bedclothes at night, the perspiration of the scalp, and the frequent occurrence of bending or fracture of the bones, are symptoms of unmistakable import. In early cases, the disease may generally be detected by the condition of the epiphyses and the shape of the chest.

The medical treatment of rickets is much the same as that of scrofula. The child is to be fed upon nourishing and simple food; the skin is to be exposed to healthy action by periodical bathing and sponging; the state of the secretions is to be carefully attended to. Cod-liver oil appears in most cases to be beneficial, and a little iodide of potassium may be combined with it; or the syrup of the iodide of iron, or some of the preparations of iron. Phosphate and superphosphate of lime used to be combined with iron at the Hospital for Sick Children, under the idea of supplying material directly for the consolidation of the bones; but after a patient trial, it was thought that the cases did not do better than under the use of iron alone.

The surgical treatment of rickets is a matter of more doubt. Some physicians teach that the deformity of the limbs cannot be reduced by splints; but the weight of the splints on the lower extremities is liable to be injurious to the pelvis, and increase its tendency to deformity, while it is a great obstacle to the use of the weakened muscles, and so hinders healthy exercise; and for these reasons discard the use of splints altogether, and advise that the child should be kept at rest and hindered from walking, when the healthy action and balanced tone of the muscles will, it is hoped, do what is possible to redress the curvatures of the softened bones. But, with submission to the opinion of high authority, I cannot help thinking that this is an error. I believe that I have seen crooked limbs very materially straightened by the judicious use of light firm splints, always supposing that the case is presented to the surgeon before the stage of consolidation has arrived; for afterwards the use of splints can only do harm. At any rate, they exercise a most beneficial influence in opposing further deformity; and in cases where it is important to prevent the child from standing or walking, they may be so applied as to support the child below the foot, and they more effectually prevent locomotion than the attention of the nurse or mother could do, more especially among the poor, who have seldom the power of attending exclusively to one child. For these reasons, I am in the habit of using splints in most cases of rickets where the bones appear still softened. They should be removed at night, and replaced after the child has been washed in the morning. They should be well padded, and are best fixed by a long piece of the webbing which is used by saddlers. On no account should splints be used longer than while the

* In this stage of rickets premature consolidation of the diaphyses and epiphyses sometimes occurs, leading to still further want of height, and to the dwarfed condition occasionally noticed.

bones appear to be softening. After consolidation is effected, their pressure can do no good to the curved bones, while it will assuredly cramp the action of the muscles and impede the restoration of their power.

T. HOLMES.

LATERAL DISTORTION OF THE SPINE.

Lateral Distortion denotes deformity of the bones of the spine and chest; with corresponding change of the structures in relation to them. It is called 'lateral' from the spine being curved sideways; and to distinguish it from 'angular' deformity, in which the spine is directed from behind forward, owing to excavation in its forepart from caries.*

In extreme cases of lateral distortion there is as great disfigurement as in the worst cases of deformity from disease. Yet the changes in the structures are effected by processes to which it would be incorrect to apply the term morbid. They are to be regarded as modified actions of interstitial absorption and nutrition. Consequently it would have been out of place to treat of the distortion in connexion with diseases of the spine. Again, owing to its commencing and finishing its course in early life, it is properly included among affections incident to youth.

The exact age when lateral distortion may be first looked for cannot be stated definitely. Being unattended with illness or pain, it begins insidiously; and is seldom detected or suspected till it has made considerable progress. Taking a broad margin, it may be alleged that it is not often observed before ten, and is generally recognised before fourteen, years of age. Its course varies in rapidity; in some cases it takes only half a year to reach its worst condition; in others the period is longer. At sixteen the patient may be considered free from much liability to its increase.

Lateral distortion is especially noted for being more frequent in females than males. It is also distinguished by being more common in the daughters of the rich than of the poor.

General Appearances.

These vary in different cases; but, on a general survey, a typical form can be recognised. According to it, two distinct curves coexist in the vertebral column—one situated principally in the lumbar, the other principally in the dorsal region; and the former opposed in direction to the latter; so that together they describe a serpentine line, like the italic letter *f*.

Combined with each lateral curve there is contortion—a partial rotation of the particular portion of the column on its long axis. And the movement performed is that of the vertebræ being wheeled anteriorly on the concave, and posteriorly on the convex, sides of the curves respectively. Hence: both curves and contortions in the two regions are in contrary directions, the spine presents a spiral appearance; not unlike what might have been produced if it had been taken, when soft, at both ends by the two hands, and twisted as a washerwoman wrings a wet cloth.

It is a distinguishing feature of lateral distortion that the curves generally follow a uniform direction; that is, the dorsal curve will be found in a largely preponderating number of cases, concave on the left; which again, implies that the lumbar is concave on the right.

When the dorsal curve is formed lower down than usual, it is common for another to exhibit itself above, and in an opposite direction, extending partly into the cervical region.

Chest. The combined incurvation and contortion of the vertebræ in the dorsal region lead to corresponding displacement of the ribs attached to the Hence general disfigurement of the trunk—chest, abdomen, shoulders, hips ensues. From the curve in this situation having its convexity on the right

* See DISEASE OF THE SPINE, vol. iii. p. 831.

the ribs on that side diverge like rays of a fan; the intercostal spaces are widened, especially at their distal ends, and the capacity of the chest is increased. Again, owing to the accompanying rotation of the vertebræ, the diverging ribs are at the same time carried posteriorly; thereby producing a bulging of the side backward. Hence the right half of the chest is both abnormally expanded and protuberant behind. Next, in regard to the left, or concave side, the ribs here converge, and the intercostal spaces are narrowed, as the result of the lateral inclination. But the rotation of the vertebræ causes the same ribs to be protruded anteriorly. Accordingly the left half of the chest is abnormally contracted and depressed, as looked on posteriorly. Turning the eye to the front, it is found, as might be anticipated, that the costal cartilages of the ribs, which, at the back, project posteriorly, are deficient in rotundity; and *vice versâ*.

Hump. In advanced stages of the distortion the dorsal curve increases chiefly within a limited part of the region, so as to be rendered more or less angular. The attending contortion is similarly abrupt; the circumvolution of the vertebræ, in some cases, approaching to a quarter of a circle. As the combined changes occur, the ribs on the concavity are greatly squeezed and reduced in size; while the intercostal spaces are either considerably diminished or obliterated; thereby causing the area of the interior of the chest to be lessened, and the movements of the compages in respiration to be interrupted. On the convex side, in proportion as the vertebræ rotate, the ribs are drawn toward the spine, in the same manner as a band in machinery is drawn toward the revolving barrel round which it is wound. The first effect of the travelling of the ribs toward the centre is a flattening of the side of the thorax, and abridgment of the transverse diameter. But as the rotation goes on, the posterior ends of the ribs, from their articular heads to their gibbrosities or angles, become curved and coiled about the vertebræ. A sharp ridge, consisting of the bent angles in a continuous line, commonly projects posteriorly beyond the level of the spinous processes, so as to overlap them, and constitute the apex of the gibbosity. Owing to the pleural surfaces of large segments of the ribs being thus brought into contact with the sides of the vertebræ, a corresponding portion of the cavity of the thorax is necessarily cut off; and that again implies a proportionate shrinking and wasting of the lung.

Inequality in the level of the shoulders. As the two scapulæ ride freely on the summit of the chest, retained in their places merely by the muscles and ligaments, they rise, sink, protrude, or recede, in conformity with the movements of the upper ribs. As on the convex, or right side, the ribs are not only elevated but directed posteriorly, the scapula is both lifted above its ordinary level and thrust backward. Thus the right shoulder is high and bulging, and is close to the body. On the concave, or left side, the upper ribs are depressed and carried forward, producing a general collapse of that portion of the chest; therefore the scapula, being bereft of support, falls down below its proper height. Accordingly, the left shoulder is low and flat; and standing apart from the body, it has a pendulous unsupported appearance. In extreme cases, where, from the winding of the ribs about the spine the convex side has been diminished in rotundity, the right scapula will descend from its former elevated position, and fall to the level of its fellow on the left. Occasionally the rotation of the chest, including the shoulders, is so excessive, that the right flank of the body will face the rear, and the left flank the front; the clavicles will travel simultaneously; and one of these has been known, from the extent of revolution, to be dislocated at its sternal articulation.

Waist. The effect on the shape of the loins by the subsidence of the lumbar column may now be attended to. Owing to the thickness of the mass of muscles and skin covering the lumbar vertebræ, as well as the falling-in of the back, the detection of a newly-formed and slight curve in this situation, however important, is not always easy. An early indication of the commencement of incurvation will be found in the general aspect of the waist. It

being a necessary consequence of the spine being diminished in length by the curvature, that the lower borders of the thorax descend so as to approximate the upper margins of the pelvis, the waist becomes short, broad, and square. That appearance will be aggravated by the patient standing indolently in a lounging position. If the curvature be recent, the natural slimness may be restored by the patient making an effort to mount up her body to its full height; or by directing her to lie on the sofa, and then stretching the spine.

On comparing the two sides of the loins, they are seen to be unsymmetrical. The right, or concave flank, is more expanded, is flatter, or more sunken, than the left, especially if the patient slouch as she stands. A distinct flexure, which is wanting on the left, will also be perceived. These appearances are obviously due to the spine being deflected away from the right; and to the vertebræ being rotated with their right sides pointing forward, thereby adding to the hollowness, viewed posteriorly. The left or convex flank is chiefly remarkable for its greater narrowness and increased fulness. The former peculiarity is accounted for by the lumbar vertebræ being turned toward it; and the fulness is owing to the vertebræ being rotated with their left sides pointing posteriorly. By the latter movement the transverse processes, with the muscles overlying them, project backward, causing a prominent ridge, the inner edge of which overlaps and partially obscures the tips of the spinous processes. To ascertain the extent and nature of the curve, it ought to be examined on each side. By inserting the points of the fingers along the right, they will sink deeply and meet no solid resistance; but on the left they will encounter a round hard mass, apparently a tumour, which consists of the bodies of the vertebræ twisted round toward that side. The inequality in the level between the two flanks will be rendered more distinct if the patient be asked to stoop forward, so as to cause the lower part of the spine to protrude.

In advanced cases, the waist—a special element of elegance in the contour—suffers yet more injuriously from the effects of the lower curve. Owing to the intrusion of the lumbar vertebræ on the left, the hollow between the ribs and crest of the ilium, constituting the proper constriction or flexure of the waist, is filled up: hence the distinction between hip and loins is lost; and a substitute for the waist must be sought for at a higher level. Now the only hollow on the left side resembling that which ought to be directly above the crest of the ilium is a constriction situated altogether above the lumbar region, namely, the hollow in the chest, just below the scapula, caused by the convergence of the ribs on the concave side of the dorsal curve. Such, then, is the only representative of a waist on the left. But on the right, instead of the lumbar vertebræ encroaching on the hollow, they recede from it, and cause the flexure to be deeper than natural. Owing to that, and to the mode in which the ala ilii, from being deserted, juts out like a promontory, the constriction of the waist on the right is peculiarly distinct. Accordingly, on the left side of the body the flexure corresponding to the waist is situated very high near the axilla; whereas the flexure on the right is relatively low, being in its usual place above the haunch. Hence the cross-line representing the waist is remarkably oblique. And its dip is the reverse of that from shoulder to shoulder, which is high on the right and low on the left. But both these lines ought to be parallel and horizontal. Thus the elevated and protuberant right shoulder is counterpoised below, and on the left, by the elevated and protuberant haunch; and the unsupported, sloping, pendulous left shoulder has a counterpart below, and on the right, in the sunken waist and projecting isolated ala ilii.

Pelvis. Further observations will presently be made on the figure and dimensions of this girdle of bones. Here it may be noticed that the conjoining incurvation and contortion of the lumbar vertebræ have the effect of turning the pelvis awry in relation to the thorax, affecting it both in its horizontal and vertical planes. The only deformity that can be observed within itself consists in the left side of the sacrum being about a quarter of an inch nar-

power than the right. This trifling diminution may be looked on as the rudiment of a curve in continuation of those in the spine. It represents in the false spine, as the sacrum has been called, the concavity of a curvature in counteraction of the lumbar one.

Gait. In natural walking no indifferent part is played by the joints of the spine. As the right leg, with the side of the pelvis, advances, the right arm, with the side of the chest, recedes; and *vice versâ*. That succession of alternating motions is evinced by the swinging to and fro of the arms during either walking or running. It is effected by a twofold rotatory movement of the spine on its long axis; according as the lumbar vertebræ, connected with the pelvis, wheel partially round anteriorly, as the right leg advances,—so the dorsal vertebræ, connected through the ribs with the right shoulder, wheel partially round posteriorly; and *vice versâ*. Thus the force of movement in one direction is dispersed and lost by the counteracting force in the other, and jarring is prevented. But in lateral distortion the relations of the various articular surfaces of the spine have been so much deranged, that the movements referred to cannot be performed; and the patient exhibits a halting, jerking, awkward gait.

Causes of Lateral Distortion.

Neither at the outset nor during the progress of this distortion is the health affected. After death the involved structures exhibit no signs of morbid action. Thus the question is narrowed to the inquiry by what processes, apart from disease, can the changes wrought in the bones and joints of the spine and chest be produced. It may be premised that no explanation can be deemed satisfactory which does not include reasons for the following distinctive characters: 1st, that the distortion takes place between ten and fifteen years of age; 2dly, that it is more prevalent in girls than boys; 3dly, that it affects the offspring of the rich rather than of the poor; lastly, that the curves follow certain uniform directions.

Suppleness of the spine in the young. Looking for the most general cause of lateral distortion, it will be agreed that it consists in the vertebral column, from its flexibility and weakness, being incapable of withstanding the pressure of the superincumbent weight. At the specific age for the production of curvatures, the spine is nearly of its full length; but its structures are more gristly than bone. The column is then chiefly characterised by the soft and spongy consistence of the vertebræ, and the disproportionate quantity of its fibrous and cartilaginous constituents. In young people of both sexes the spine is more flexible to a notable degree than at adolescence. Thus the very immaturity of the construction is an essential cause of the tendency in the spine to be deflected under pressure.*

Weakness of the muscles. Assuming, what will not be contested, that muscles degenerate and become weak if deprived of proper exercise, several obvious reasons will present themselves why those in girls should be inferior in strength to those of boys; and why those in girls of the richer classes should be weaker than those in girls of the labouring classes. It is to be remarked that the age at which the spine tends to be distorted coincides with that at which an important change takes place in the constitution of the young female; and it is known that when that time approaches, the moral character is more or less influenced. What principally concerns our subject is, that the girl, becoming more feminine in her disposition, ceases to romp with her former animation, and becomes partial to sedentary occupations. Again, greater abstinence from active games is rendered necessary by the severer exactions of education. In short, at the age referred to, a young lady exchanges the freedom

* In the Museum of the Middlesex Hospital are two dissections, preserved as wet preparations, intended to show the structure of the vertebræ and articulations, in females, at eleven and twelve years of age respectively.

of the nursery for the strict discipline of the schoolroom; and her opportunities of taking exercise sufficiently long continued and diversified for preserving the muscles in condition are apt to be prejudicially limited.

Deterioration of osseous and ligamentous structures follows muscular debility. But when muscles lose in power, the loss is felt beyond their own sphere. It is a law of the animal economy that a close relation should exist between the muscles which originate force, and the ligaments and joints which bear the brunt of the force. The mutual connexion may be illustrated by the case of the trained boxer. In proportion as the muscles of his arms increase in bulk and power, the bones become denser and stronger, and the structures of the joints more tough and tenacious. Were it otherwise, when he dealt a heavy blow on his adversary's head, his humerus would be shivered, or his wrist dislocated. The converse is equally true. In proportion as the muscles are weakened and degenerated in structure from deficient exercise, the bones and ligaments conform themselves to the condition; the former become more spongy; the latter softer and more easily overstrained. Hence, applying the principle to our subject, it will be seen that muscular debility, apart from other obvious and direct bad effects, tends to make all the component parts of the spine—vertebræ and articulations—more prone to sink under the weight and be distorted.

Loosening of the vertebral joints from stooping. Were we to enter a school-room shortly before the breaking-up of the class, we should find nine out of ten of the pupils standing or sitting in a tired lounging position. Instinct informs us that we can relieve the pain of over-fatigue by throwing the weight on the insensible fibrous structures, and thus emancipating the muscles. But when such attitudes are long indulged in, the fasciæ, intermuscular septa, aponeuroses, and ligaments undergo a process of over-stretching, and a general relaxation ensues. Therefore a comparatively harder task is imposed on the muscles to keep the spine erect.

Why do the curves pursue a particular direction? The causes enumerated above will sufficiently explain how the vertebral column should be liable to distortion independently of morbid action. But they do not account for the fact that, in a large majority of patients, the curvatures follow one line in preference to others; namely, that of the lumbar curve being concave on the right, and the dorsal of course on the left.

Lumbar curve the first. It will facilitate the inquiry to decide which curve precedes the other. Anatomical knowledge points to the probability of the curve in the loins being the primary one. Besides the lumbar being the most flexible region, and therefore, when weak, most prone to succumb, its situation at the base of the pillar causes the greatest amount of weight to be thrown upon it. But the vertebræ of the loins are set on a foundation which is ever varying its level. The pelvis, with the sacrum in its centre, rolls to and fro on the globular heads of the femora, not unlike a ship tossed in the ground-swell of a sea, pitching and lurching at every act of flexion or extension of the lower extremities; and with each motion, the superstructure tends to be thrown off the line of the centre of gravity. As we are endowed, however, with a quick sense of the loss of balance, the spine is bent each time to adapt itself to the declination, and the curvatures take place principally in the loins.

Standing on one leg. The well-known word of command at drill, "Stand at ease," followed by the recruit's bending and dropping the left leg, and steadying his weight on the right, expresses that, however great man's privilege to stand on two feet may be, he prefers using one only at a time for comfort. That posture is assumed because it enables the body to be kept upright with the least possible expenditure of muscular power. A special mechanism is introduced in man, by which the weight can be thrown, as he stands, on the insensible fibrous structures, with relief to the muscles. The most essential part of the contrivance consists in the strong expanded web of membrane called 'fascia lata.' That fascia being attached extensively above

to the crest of the ilium, and extensively below to the outside of the whole thigh, it is arranged that when one leg is fixed solidly on the ground, the web shall be rendered tense by the pelvis being tilted upward on the same side. In that manner the fascia assumes the office of a ligament, and supports the weight by the locking of the pelvis on the limb. But it is a condition of the proper working of the apparatus that the pelvis—the base of the spine—shall be oblique. It follows then that, in order to preserve the balance, the vertebral column must incline to the same side as that on which the foot is fixed; in other words, that a curvature of the spine must be formed. That curve will be greater, the younger the person; and it will be seen more conspicuously, on account of the dress, in a boy than in a girl. It is most considerable in the loins. The arc described by the lumbar vertebræ of a young person is sometimes nearly equal to a semicircle.*

Wasting, by absorption, of oblique processes on concave side of curve. It may thus be seen how the common attitude of standing on one leg furnishes an alluring inducement, especially in the case of a weak and fragile girl, to keep the spine bent, while appearing at the same time to hold herself erect. The next point to be considered is, how the vertebræ will be affected in their shapes by too long indulgence in the posture, supposing it to have become a habit to stand in that manner. Referring to the anatomy, it will be perceived that the only parts in the vertebræ calculated to limit their movements to either side are the oblique or articular processes. Without them, and the resistance of the muscles and ligaments, each time the spine was inclined laterally, one vertebra would glide off the other below. It therefore follows that when the muscles are debilitated, the articulations relaxed, and the spine curved in connexion with lounging on one leg, the pressure of the superincumbent weight, ceasing to be transmitted through the centres of the bodies or along the proper vertical axis, will fall exclusively on the oblique processes which are situated on the concave side of the curve, in the lumbar region. But the forms of these processes are not such as to enable them to bear with impunity such compression. They are wedge-like, thin-edged, tooth-like, bony prominences, especially subject to give way by absorption to unequal pressure, and so become shortened. Now if that diminution take place in the processes along one side of certain vertebræ, the effect will be like that of sawing the legs of a stool too short on one side. The vertebræ will always and inevitably topple to the stunted side. The curve which was at first temporary, and in accommodation to the attitude of standing at rest, will therefore become a permanently established one, causing the body to droop to one side at all times.

Contortion. But lateral incurvation will not be the only effect produced by absorption of the oblique processes. If the relative positions of these leg-like projections be observed, they will be found placed posteriorly, as well as laterally. Consequently, when the column subsides from their giving way, the vertebræ will fall sideways and backward coincidently. The two simultaneous movements, however, will result in a combination of horizontal rotation with lateral inclination. In other words, in proportion as the oblique processes of one side sink under them by absorption, the vertebræ—besides

* Under eight years of age children cannot balance themselves on one foot; the pelvis is then too narrow and the body too heavy for the mechanism to be available: moreover, from the restlessness of children, the provision would not be of much advantage. Painters, however, sometimes commit the blunder of representing mere infants as poising themselves gracefully on a single leg. Although furnished with four extremities, the horse is not without an apparatus similar to that in man: being tired, he leans all the weight of his hind-quarters on one of his hind-legs. The bird that roosts, and the bird that sleeps, on one leg have mechanisms for the same object, namely, that of economising muscular force, each varying in structure. See the *System of Anatomy and Physiology*, by John and Charles Bell, vol. i. p. 385, 7th ed.

falling sideways—will wheel round on their long axis, as if turning on pivots. Hence in this kind of distortion, contortion invariably accompanies the lateral incurvation.*

Formation of dorsal curve. So long as a patient having a confirmed curve, like that just described, continues 'standing at ease,' she will experience no inconvenience from it; the oblique direction of the pelvis is in conformity with the deviation. But the effect will be different when she relinquishes the posture and assumes any other in which the pelvis is placed horizontally. For example, the pelvis is horizontal when a person sits square, or walks straight. When a patient, therefore, in whom a permanent curve at the loins has been contracted by the habit of resting on one leg, seats herself, or gets up to walk, her body will fall to the defective side. That lurch, however, must be overcome. How is the equilibrium to be restored? The column, it might be supposed, could be reinstated by the patient making a powerful effort to unbend it where it had given way. But the changes in the adjustment of the articular surfaces of the vertebræ, consequent chiefly on the contortion, prevent that. The exertions she makes, instead of telling on the lumbar curve, are centred on the portion of spine above. The patient instinctively leans the head toward the shortcoming side; she also raises the shoulder which is depressed, and depresses the shoulder which is raised; and so flexible is the spine, that by these proceedings the dorsal vertebræ become bent in a contrary direction to the curve below. Thus the upper or second curvature, in lateral distortion, is engendered.

General regularity in direction of the curves. A part of the problem is still unsolved. How is it that, in a preponderating number of cases, the spine should deviate below to the left, then to the right, and above that again to the left? Assuming the foregoing explanation of the commencement of the distortion to be correct, it is necessary to suppose that the leg habitually used for resting upon in the attitude of standing at ease should be the right; for it is only while bearing upon it that the spine is so curved as to be concave on the right. Now, it is consistent with what is known of the relative strength of the two limbs to conclude that the right should be commonly preferred to the left. While standing, people generally shift continually from one foot to the other, thereby marring attempts at comparison; and it is not easy to decide the question by actual observation. Nevertheless, it is an acknowledged law in physiology that the right side of the body is stronger and more obedient to the will than the left. Mankind are right-footed, as well as right-handed. It may therefore be affirmed that over-indulgence, by those already prone to distortion, in the habit of resting on the right in preference to the left leg, while standing, is the cause of the spine being incurvated in the direction so generally observed.†

Dorsal curve sometimes in excess. From what has preceded it will be perceived that one of the worst effects of the spine deviating from a perpendicular line is, that the pressure of the superincumbent weight, which ought to be divided equally among all the surfaces of contact in the individual vertebræ, is thrown disproportionately on the side toward which the body leans; and as the lateral parts are not constructed for bearing the extra pressure, they undergo absorption, and the curve progressively increases. Although it has been shown, in treating of the order of formation of the curves, that the lumbar appears first, it does not necessarily follow that it should eventually become the worst. Cases are occasionally met with in which the dorsal curve is slight, and that in the loins very considerable. But when one surpasses the other, it is commonly the dorsal. Indeed the upper is not unfre-

* This explanation of the production of contortion was first given by the writer in his paper on Rickets, in the *Med.-Chir. Trans.* vol. xvi. p. 468, 1832.

† In all disciplined armies, the posture of 'standing at ease' is to rest on the right foot. For other illustrations, see *Treatise on the Hand*, by Sir C. Bell, p. 92, 6th ed.

quently so aggravated in comparison with the lower, that it appears the only one. Now the greater liability of the dorsal curve to overstep the lumbar may be accounted for by the difference in the anatomical structure of the two regions. In correspondence with their being near the base, the lumbar vertebræ are both broader and flatter than the dorsal; and the region itself is shorter than that above: whence an extensive curve is not likely to be produced within its limits. But what principally determines the difference is the contrast between them in regard to elasticity. It is known that an elastic force is more effectual in opposing absorption from compression than a dead resistance. Take the illustration of an aortic aneurism. What contiguous structures yield the most readily to its encroachment? It is the solid bones—spine, ribs, or sternum. The elastic parts, as intervertebral substances, costal cartilages, and integuments, hold out the longest. Applying the principle to our subject, the dorsal portion of the spine is characterised by its comparative stiffness; the lumbar, on the contrary, by its extreme elasticity. Accordingly, when the pressure of the superincumbent weight bears on the dorsal vertebræ, it is met by rigid opposition; but when it falls on the lumbar, it is stopped by a lively, resilient force, which moderates the activity of interstitial absorption.*

Accommodation of surrounding structures to the curves. In correspondence with the new forms assumed by the column generally, the individual parts adapt themselves to the change in their relations. The bodies preserve their thickness on the convex sides of the curves, but undergo a thinning on the concave; they also present a skewed appearance in accordance with the contortion. The intervertebral substances likewise are modelled to harmonise with the bones. However acute the inflexions, or tortuous the twistings, in cases of hump-back, the vertebral canal is shaped in exact correspondence, and the spinal cord follows its sinuous course. But although these extensive alterations are wrought in the cord, particularly large subtractions from its substance at the seat of the concavities, the organ is unimpaired in its functions. Again, from the jamming together of the vertebræ and ribs at the concavities, a certain number of the vertebral foramina are almost closed; the nerves transmitted by them are therefore either greatly atrophied or obliterated; nevertheless, seldom or never are painful or other nervous affections observed in connexion with these remarkable changes.† Within the thorax and abdomen the viscera adapt themselves to the changes in the construction of the chambers they occupy; and great as the transformations and transpositions of the solid and floating contents are, they are silently effected without interference with the performance of their functions.‡

* The stoop, or round shoulders, so troublesome to governesses,—the “cat’s-back” of the schoolroom,—is principally to be ascribed to the anterior edges of the bodies of the dorsal vertebræ being prone to become absorbed from absence of elasticity. A similar habit of stooping at the loins does not produce like bad effects.

† A lady, past middle age, having had lateral distortion since girlhood, and been obliged to wear iron spinal-supports embracing the hips, suffered intense pain over the crest of the ilium, on both sides, from neuromata in the dorsi-lumbar nerves; obviously produced by friction of the hoop of the instrument. Like other patients, she had no pain referable to the dorsal nerves; yet they must have been compressed on the concave side of the curve, and similarly irritated. See the essay on DISEASE OF THE SPINE, vol. iii. pp. 840, 859.

‡ In obedience to such a slight force as that exercised by a cicatrix from a burn, the forms of the bones may be affected. A remarkable instance was furnished in a case recorded by the writer, of a patient who had been burnt in the neck while a child. The mental portion of the inferior maxilla was bent downwards, by the contraction of a cicatrix which reached from the lower lip to the sternum, to such a degree that the incisor-teeth assumed a horizontal instead of vertical direction, and the tongue protruded (*Trans. Path. Soc.* 1849-50, p. 241). In torticollis, the half of the head drawn down toward the breast is perceptibly smaller than the upper.

Weakness of spine at interval between the curves. The impairment of motion at each curve, caused by disturbance in the relations of the various articular surfaces of the vertebræ from the combined incurvation and contortion, has already been noticed. Owing to that loss of flexibility, a greater stress is necessarily thrown on the bones and joints occupying the space between the two curves. In the majority of cases, the neutral ground coincides with the union of the dorsal and the lumbar regions,—a part of the column formerly shown to be naturally weaker than others, chiefly from defective interlocking of the processes, and general relaxation of the articulations.* Hence there is greater proneness in the dorsi-lumbar vertebræ to be loosened in their connexions, and have their range of motion increased, when they have thus become the principal centres of mobility in the column. Accordingly, in examining patients to ascertain the comparative flexibility of the different parts, it will be found that while forcible stretching of the back has scarcely any appreciable effect in straightening the curves themselves, it produces a very decided elongation of the portion between the two. Moreover, in making post-mortem examinations (as the writer has had frequent opportunities of doing) of patients with distortion who have died from some general disease, his attention has been particularly drawn to the freedom of motion, almost equal to that of the knee-joint, existing in the small space between the dorsal and lumbar curves.

Diagnosis.

The only deformity confined, like lateral distortion, to the spine and chest, subject to be confounded with it, is that caused by caries of the bodies of the vertebræ. But to distinguish between them is generally easy. It is only in those cases of angular curvature from disease in which, from some accidental complication, the spine has fallen to one side, that a difficulty can exist. Instances, however, of that kind are rare. Owing to the presence of the ribs, a lateral deviation in the thoracic region is seldom met with. It is at the more movable dorsi-lumbar region that the inclination is most likely to take place. When the combination is found, an unerring diagnostic symptom is the absence in angular curvature of contortion of the affected vertebræ. In lateral distortion, so great is the rotation of the spine on its long axis, that the transverse processes project in the place of the spinous; and the latter are wholly or partly hid by overlapping of the longissimus dorsi. But in angular curvature the tips of the spinous processes are distinctly defined, and are the most prominent points presented, not only to the touch, but the view; furthermore, the bend is obviously a simple subsidence to one side, unaccompanied with torsion. Any doubt will be removed by observing the flexibility of the affected part. If the range of motion be limited, it will be a sign of disease; if extensive, it will denote lateral distortion.†

Rickets. The etymology of this term points to its having been originally applied to deformities of all kinds that involved the spine. The idea has not yet been quite banished, that lateral distortion is either induced or promoted by the prevalence in the osseous system of a morbid condition such as the name implies, namely, a softening, which leads to the bones being deformed from pressure. But as this particular distortion is especially frequent in females, and the most formidable of the consequences of true rickets is deformity of the pelvis, perilous both to mother and child in parturition, it is important to decide whether there be any foundation for the opinion. Now many arguments can be adduced to prove that rickets takes no part in the production of ordinary lateral distortion.

1. Rickets is essentially a disease of childhood. But the age at which

* INJURIES OF THE BACK, vol. ii. p. 199.

† See DISEASE OF THE SPINE, vol. iii. p. 838.

lateral distortion commonly begins is from ten to fourteen. 2. Males and females are affected by rickets in equal proportions. But females preponderate in lateral distortion. 3. Rickets prevails mostly among the children of the poor. Lateral distortion prevails among the daughters of the rich. 4. Rickets is a positive disease, with special symptoms and pathological conditions. The health, in lateral distortion, is unaffected; and no abnormal appearances, apart from the distortion, are exhibited after death. 5. A bowed condition of the tibiæ and fibulæ near the ankles is a distinctive sign of rickets. The bones of the legs, in common with all the other columnar bones, except the spine, are straight in lateral distortion. 6. As to the form of the pelvis, Mr. Wilson maintained that a morbidly soft condition of the osseous system invariably preceded lateral distortion, and was its principal cause: on that ground he objected to heavy iron supports being used for its cure, believing that they compressed the pelvis, and gave rise to deformity dangerous to child-bearing women. Treating of the same subject shortly afterwards, Mr. John Shaw proved satisfactorily that, in lateral distortion, the bones were free from any disease like rickets; that the pelvis preserved its natural shape; and he further stated that in no case would the pelvis be found deformed, except when the bones of the lower extremities, especially the tibiæ and fibulæ, were visibly bent from rickets.*

7. In addition to the incurvations of the bones by which rickets is familiarly known, the disease gives rise to certain appearances different from what are ever seen in lateral distortion. The changes are connected with the relative proportions of the body.

Peculiarities in the figure caused by interruption of the growth from rickets. Besides causing degeneration and softening of the bones, rickets in its active stage has the effect of retarding or arresting the growth. The marasmus, and imperfect supply of earthy salts to the bones attending it, prove that the nutritive functions are impaired. The diminutive size of those who have outlived the disease is further proof; for independently of the loss of height consequent on incurvation of the spine and bones of the legs, rickety individuals are remarkably small in all their dimensions.

By stopping the growth, rickets produces notable effects on the configuration as distinct from the stature. These relate to important changes in the proportions of the members of the body that occur during the passage of the child from infancy to manhood. The figure of a man at maturity is not merely the magnified figure of a newly-born babe. One set of proportions belong to the one age, and a different set to the other. Now a temporary cessation of the growth from rickets interferes with these changes being effectually carried out. Accordingly the skeleton of an adult who has suffered from the disease in childhood is deficient in the proportions distinctive of manhood, and exhibits traces of the original conformation of the infant.

It will facilitate the understanding of the subject to notice some of the stages in the transition of the child's figure to that of the adult. And it will be apparent that the changes in the relative dimensions are chiefly influenced by the order of development of the great centres of the nervous system—the brain and spinal cord. It will be convenient to point out, first, the relative proportions of the head, comparing the cranium with the face; secondly, those of the entire body, comparing the head and vertebral column (as far as the spinal cord reaches) with the pelvis and lower extremities.

Form of infant's head contrasted with that of adult. The dimensions of the cranium correspond to those of the brain; its growth is therefore regulated by that of the encephalon. The dimensions of the face, on the other hand, correspond to those of the organ of mastication principally; its growth is therefore subservient to that of the teeth and their appended apparatus.

* See *Lectures on the Bones and Joints*, delivered before the College of Surgeons, by James Wilson, 1820; also on *Distortions of the Spine and Chest*, by John Shaw, 1823.

In the development of the brain, the principal peculiarities are—that it is of comparatively great magnitude during foetal life; that its growth continues rapid during the first septennial term; but that it is afterwards so slow that the increase is scarcely discernible. Accordingly the cranium ceases to enlarge, except to a slight degree, after seven or ten years of age. It is different with the organ of mastication. During foetal life, and for about a year after birth, the gums are toothless. The first set of teeth are small, are gradually shed, and are replaced by a larger and more numerous series. But the growth of the whole dental framework, embracing teeth and large bony surfaces for attachment of powerful muscles, is not completed till about the age of twenty-one. Hence it will be seen that, although at the first start the cranium made rapid strides, so as to outstrip its rival, it soon relinquished the contest; and again, that the face, although it proceeded throughout at a slow pace, kept up the race for above double the length of time. The result therefore is that, at the expiration of the period of growth, the original relative difference between them is greatly reduced. Corresponding measurements of the two divisions respectively being made in skulls of the infant and the adult, it will be found that at birth the face is to the cranium as 1 is to 8; while at maturity it is as 1 is to 6.

Form of infant's body generally as contrasted with that of adult. In the entire figure the upper and lower divisions, assuming the line of the crest of the ilium as a boundary, undergo similar modifications of relative proportions to those in the skull. The conformation of the foetus has an obvious relation to the act of parturition. Such is shown to be the case even at the embryonic period. The upper division being then preponderatingly large, and the whole immersed in the liquor amnii, the head gravitates, and takes its place over the orifice of the womb; it remains there all the period of gestation, ready to bear the first brunt of labour-pains when the appointed time arrives. The pelvis, included in the lower division, is kept small and narrow, that it may not offer any obstacle to the rapid expulsion of the hips and umbilical cord after the delivery of the head. But the proportions adapted to such a heels-over-head position in the womb are incompatible with man's privilege of standing upright. Hence for a certain number of months the babe is consigned to the bosom of the mother. For maintaining the erect posture, it is a necessary condition that the upper division, or burden to be carried, shall be small and light; and that the lower, which has to carry it, shall have length, breadth, weight, and strength. Now that change of equipoise is effected by an inequality of the rate of growth in the two divisions—by the process being more active in the pelvis and lower extremities than in the structures situated above. The result is that, according to measurements, the length of the inferior division compared with the superior is, at birth, as 8 to 10; but at adolescence, as 8 to 5.

Such being the transitions during the season of growth in the relative dimensions of the head and entire body respectively, it will not be difficult to understand how a temporary suspension of the process, through the influence of rickets, should prevent the figure from acquiring the distinctive proportions of manhood.

Proportion of cranium to face in rickets. Let the head be taken first as an example. If the skull of a rickety individual be compared with a normal one, the former will be found diminutive altogether. But the defalcation will be decidedly greater in regard to the face than the cranium, in the morbidly-affected skull. The difference may be visible to the eye, and be shown also by comparative measurements. It has been already stated that, in the adult skull of average form, the ratio of the face to the cranium is as 1 to 6. Measurements of numerous rickety skulls show that the ratio of the face to the cranium, in them, is as 1 to 7. Accordingly, as at birth, the ratio is as 1 to 10, the proportions of the morbidly-affected skull approximate to those in the child. It may be asserted, with tolerable correctness, that the head of

an adult stunted by rickets is represented—so far as regards relative dimensions—by the head of a youth ten or twelve years of age.

Proportion of upper to lower division of body in rickets. Attending next to the proportions of the entire figure in an adult whose growth has been interrupted by the disease, it is apparent that, although both divisions are beneath the ordinary length, the inferior, consisting of pelvis and lower extremities, is much more diminutive than the superior, consisting of the head and trunk. The deficiency in the upper is so slight as to be scarcely discernible. But in the lower it is so great that the peculiar shortness of a person affected with rickets depends almost altogether on the curtailment in his inferior extremities. The distinction is remarkable in seeing one stunted by the disease and another of normal proportions seated together: then both seem to be of about the same stature; but if they rise, the rickety person appears to descend, so much is his height diminished by the want of length in his legs.

Undergrowth of the pelvis. And here an important subject, bearing on a practical question in midwifery, claims attention—namely, the smallness of the pelvis, independently of deformity, in cases of rickets. In the rearing of the skeleton, no part undergoes greater relative augmentation than this circle of bones; hence if checked in the progress of its enlargement by a suspension of the growth, so much more extensive will be the defect in its magnitude. Accordingly, comparative measurements have shown that, whereas the dimensions of the pelvis in its normal condition are represented by the number 7, those of the pelvis, whose development has been temporarily arrested by rickets, are represented by only $5\frac{1}{2}$. Such an amount of inferiority implies that there is a corresponding diminution in the length of all the diameters of the pelvic canal along which the infant is expelled. A patient, therefore, who has been affected by rickets, is exposed, when parturient, to difficulty in labour from two distinct causes connected with the pelvis. First, the inlet and outlet will be irregularly narrowed and devious from the deformity of the walls; secondly, they will be uniformly diminished in width and capacity, or the pelvic canal will be reduced in calibre below the standard size, by imperfection in the growth.*

Converse relative proportions in a tall man. Whether we examine the head or the entire figure of an adult whose growth has been temporarily arrested by rickets, we shall find the proportions characteristic of the child's form impressed upon it with more or less distinctness. But the influence of the rate of growth in modifying the relative dimensions is exhibited when it is

* The deformity in the pelvis may be conjecturally estimated by taking the incurvations in the spine and legs as a guide. But the deficiency in growth does not appear to have any fixed relation to the deformity. A case of rickets was recorded by the writer, in which embryotomy was performed, followed by death. The pelvis was almost normal in shape; but it was at the same time of child-like smallness; and the fatal result was undoubtedly to be ascribed to the interruption of the growth (*Med. Gaz.* Nov. 1835). When the accoucheur attempts to judge of the relative dimensions of the pelvis, he is apt to be misled by two deceptive appearances. First, he is likely to regard the girdle of bones as entering into the upper division of the body; and from seeing that it has undergone comparatively little diminution, he may be led to infer that the pelvis is of its ordinary dimensions, or reduced in size only to a slight degree. But he ought to bear in mind that the pelvis, in its rate of growth, follows the lower division, not the upper. In calculating its size, therefore, he ought to take the condition of the inferior extremities as the proper test. Secondly, a counterfeit appearance is produced in the region of the pelvis, by certain changes in the form of the thigh-bones. In the softened state of the skeleton, the superincumbent weight falls on the necks of the femora, so as to cause their heads to be depressed. Consequently the pelvis subsides to an equal degree, and the trochanters assume a relatively high place on the flanks of the ossa innominata. An increased breadth and fulness, not unlike the natural contour, is thus given to the hips, which would otherwise be narrow. The bowed condition of the thigh-bones, at their upper ends, likewise assists in disguising the smallness of the pelvis.

accelerated as well as when retarded. That will be evinced on examining the configuration of a man of extraordinary height. The changes might be anticipated; for when a preternatural impulse is given to the process generally, those members will run into greatest excess which possess greatest activity of growth. Let the proportions of the head, as before, be taken first. As a whole, the skull is of large dimensions: but, on a closer scrutiny, it will be remarked that the increase is unequal in its two divisions; that whereas the cranium is but slightly advanced beyond the average size, the augmentation in the face is excessive. Reverting to numbers for expressing the distinction, and referring to the skull of the giant Byrne* as a striking illustration, it may be shown, by comparative measurements, that, as in the child at birth the ratio of the face to the cranium is as 1 to 10, and that in the normal adult as 1 to 6, it is in the gigantic skull as 1 to 4 $\frac{3}{4}$. Thus the cranium, from being restricted in its growth, fails to keep its normal relative dimensions; and the face, from being comparatively unrestrained, becomes disproportionately large. Analogous effects are witnessed in the entire figure. However lofty the stature of the man, the increase of the height in the upper division, that is, in the body measured from the crown of the head to the crest of the ilium (or part corresponding to the united length of the brain and spinal cord), is slight and scarcely noticeable; whereas the increase in the inferior division, including the pelvis and lower extremities, is so great that it may be considered to make nearly all the difference in the stature. When a tall man sits beside another of common size, their heads are about level; but when the former rises, he overtops all around him; and the crest of his ilium nearly reaches the breast of any standing by. Appealing again to numbers for illustration, the ratio of the upper to the lower division, at birth, is as 10 to 8; in an adult of common dimensions it is as 5 to 8; but in a man of extraordinary height it may be as 4 to 8.

Accordingly, the relative proportions distinctive of manhood, in a preternaturally active condition of the growth, are overstepped or exaggerated; just as we have seen that in an impaired or retarded condition from rickets they are not fully attained, and exhibit traces of those of the child.†

In applying the preceding observations to the question, whether rickets has any share in the production of lateral distortion, it may be affirmed that they give no support to the hypothesis. All the changes in the figure begin and end while the growth is actively proceeding; yet no signs of its being retarded are ever seen. On the contrary, at the very time that the trunk is, every month, getting shorter from the bending down of the spine, the patient is becoming taller by the increasing length of the lower extremities. The pelvis likewise deepens and expands in a perfectly natural manner.

Prognosis. However slight a curve in the spine of a young girl may be, it ought to be deemed of importance. It has been seen that when the column inclines laterally, even to a trifling degree, the superincumbent weight ceases to be supported in the line of the vertical axis, and falls almost exclusively on the oblique processes of the side alone to which she leans. These sharp-edged props are rapidly diminished in length by absorption; and then general distortion commences. In every recent case prompt and efficient measures to rectify the curve ought to be adopted.

Fallacy of estimating the curves by tracing the spinous processes alone. In examining a young person's spine for the detection of lateral curvature, the ordinary practice is to run the finger down the ridge of spinous processes, marking with ink each tip in its turn, so that a line is obtained which is supposed to represent accurately the extent of deviation from the proper median line. But the method is deceptive. It gives a false idea of the de-

* In the Museum of the Royal College of Surgeons.

† See two papers on rickets as affecting the configuration, by the writer, in *Trans. Med.-Chir. Soc.* vols. xvii. and xxvi.; also other communications on the subject, in the *Med. Gazette*, 1835, pp. 45, 349.

gree of incurvation in the bodies of the vertebræ, the parts most essential to the strength of the pillar. At each curve, the spine is partially rolled round in a direction contrary to what it is in the other. The effect of the twofold rotation is that the apices of the spinous processes of the upper curve range themselves almost in a continuous straight line with the apices in the lower. In other words, as the spinous processes in the dorsal curve point obliquely to the median line from right to left, and as the spinous processes in the lumbar curve likewise point obliquely to the median line, but from left to right, the tips of the processes, when traced from top to bottom, so as to include both curves, follow nearly a straight line. In regard to the bodies, on the other hand, they are twisted *from* the median line instead of toward it; consequently the curves they form are distinguished by wide sweeps, distant from the centre, and altogether at variance with those described by the spinous processes. Thus, in conducting the examination, the amount of bulging at each convexity, indicating the course of the bodies, ought to be taken into account in addition to the deviation in the tips of the spinous processes.

In anticipating the issue of a case, it should be remembered that the flexibility of the spine, in the season of youth, diminishes yearly; and that curvatures, therefore, run their course more rapidly in young patients than in those a little older. Thus distortion commencing at ten is, *ceteris paribus*, more dangerous than at fourteen; and a cure will be more probably effected at the former than latter age.

A curve seated in the lumbar region is more likely to be treated successfully than one of similar character in the dorsal. The reason is, the difference in the mobility of the two parts. Owing to their freedom of motion, the vertebræ in the loins admit of comparatively easy replacement. The natural stiffness of the dorsal portion is augmented by the distorted condition of the ribs, and resistance to extension is the more obstinate. Moreover, a better purchase can be obtained in mechanically operating on the lumbar than the dorsal curve.

When the vertebræ and ribs are excessively curved and contorted in the dorsal region, constituting a hump, the bones are so intricately displaced that it is impracticable to disentangle them and set the part straight. Yet by rectifying the lumbar curve, which may be accomplished to a considerable degree, the height of the trunk will be increased, the clumsiness of the waist diminished, and greater stability be given to the column.

If the patient's age be past sixteen, little can be done beyond checking the progress of the deformity. Whatever extensibility of the column may remain will probably be confined to the vertebræ in the dorsi-lumbar region. (See p. 852.) And from the inherent weakness of the structures, any improvement there will be merely temporary.

The best mode of testing the strength of the spine, so as to judge of the efficacy of the treatment, is, in the first place, to measure accurately the height of the patient immediately after having undergone the process of mechanical stretching; next, to allow her to sit without support for a time; and lastly, to repeat the measurement, with the view of comparing it with the previous one. The difference will indicate the greater or less firmness of the spine.

Treatment. A word may first be said in favour of preventive measures. When a girl is defective in muscular power, disinclined to take exercise, and prone to become distorted, the posture of sitting is not one of rest. The constant painful efforts she makes to keep the body erect tend to exhaust her physical powers; they are even prejudicial to the health of one who is delicate. A patient in that condition will derive benefit, besides averting lateral curvature, from being obliged to lie for two hours during the day, at divided periods, on a sofa or board. The repose obtained in that way is really recruiting.

The reason why boys are seldom distorted, and why girls of the labouring classes are less frequently so affected than their sisters in the upper, is that

abundant and varied exercise is an effectual means of preventing lateral curvature; so that, although young ladies may be debarred from joining in games legitimate for their brothers, substitutes ought to be provided. To specify these would occupy too much space. Suffice it to say that the exercises should be lively; adapted to call forth muscular action throughout all the body, particularly the trunk; of short duration; often repeated, and within the limit of too great fatigue; as far as practicable in the open air, and in the form of games. One of the results of such exercises, systematically pursued, will be that the girl will be endued with a command of the movements of the frame from head to toe; that she will acquire a tenacious grasp of the ground on which she treads; and be able to balance her body with absolute ease in every passing change of posture—a power most conducive to grace. Another advantage will be more indirect. Reference has already been made to the intimate relation subsisting between the organs that exert force and those which sustain its effects; and it has been seen that the consequence of invigorating the muscles is an increase in the solidity and closeness of structure of the bones and ligaments. (See p. 848.) Applying the principle to the structures of the spine supposed to be deteriorated, it will be understood that the strengthening of the muscles by exercise will be followed by a hardening of the vertebræ, and toughening of the ligaments of the joints, most effectual toward preventing distortion.

When deformity has actually occurred, exercises are serviceable in supplying the spine. By movements executed mainly in the trunk, the column may be alternately bent and extended, anteriorly, posteriorly, and from side to side, with a combination of rotation, so as to stretch the contracted muscles, unhinge the packed vertebræ, and expand the squeezed ribs. The ingenuity of the Surgeon will enable him to devise means for the performance of such exercises. When pursued for some time, they will have the effect of loosening the connexions of the bones, and will facilitate their falling into their proper places when extension is employed.

To promote the same end, an additional plan may be followed. Let the patient lie on one side, with a firm cylindrical pillow, six inches in diameter, placed under the gibbosity of that side, and let her rest her weight on the pillow: the effect will be to counteract and reverse the curve. The same thing may be done alternately on the two sides. The posture may be continued, each way, for a quarter of an hour at a time, and be repeated twice or thrice daily.

For producing extension of the spine, two different methods are available; and as advantages are attached to each, they are best combined. The elongation has the effect of effacing the curves; and it requires to be steadily maintained for a long period; as it is only by affording the distorted structures due time to undergo a reconversion into their former shapes, by the act of growth, that a cure can be accomplished. Hence many months' persistence in the treatment is imperative.

The methods employed are: 1st, stretching the body while the patient is recumbent; 2dly, letting the patient be upright, and trusting to elevate the column by artificial supports.

By the system of reclining, perfect security against dangerous pressure on the weak structures of the spine is obtained. Facility is likewise given to apply force, in various degrees, for elongating and keeping the column constantly straightened. But the confinement, comparative seclusion, and interference with the pursuit of education, are objections. It cannot, however, be admitted that the plan is prejudicial to the health: experience shows that when the reclining is often broken into by exercises, regularly performed at appointed times, the patient decidedly improves in physical condition.

Next, regarding spinal supports. The claims of such instruments to preference, in the treatment of distortion, are *prima facie* strong.—their chief recommendation being, that they allow the patient the liberty of being always

in the upright posture. For such advantage, any irksomeness caused by wearing them might well be tolerated. But their efficacy is not to be relied on. The endless variety of apparatuses of the sort invented, tried, and abandoned, evinces the difficulties and disappointments connected with them. The main obstacles to applying mechanical supports successfully, proceed from its being impracticable to accommodate the rigid substances composing them to the flexible and yielding form of a young person not fully grown. Whatever ingenuity may be exercised in furnishing the instrument with a firm fixture at the base—in introducing contrivances to hoist-up the column, or others to unbend it—inserting props for strength, or compresses to push the gibbous ribs inward—it is liable to fail; because while it retains one unchangeable form, the compressible, flexuous body, encased within, is incessantly varying its form. The remark applies with peculiar force to cases of incipient distortion in which the patients are under or about fourteen years of age. Later in life, when the vertebræ and ribs are more consolidated, a better purchase can be obtained for the centres of bearing of the supports. But unfortunately, when that time has arrived, the curvatures have become too stiff and unyielding for treatment of any kind to be of much service.

Before concluding, it might be thought proper to give detailed descriptions of various kinds of extending-beds, apparatuses for exercises, corsets, and sundry other equipments used in the treatment of lateral distortion. But all these would occupy much room; and without numerous diagrams, inconsistent with the scheme of the present work, they would scarcely be intelligible. Information concerning them must be sought in books which treat specially on the subject.

PIGEON-BREAST DEFORMITY.

This distortion consists in a protuberance of the sternum and cartilages, by which the antero-posterior diameter of the chest is disproportionately enlarged, and a distinct gibbosity produced. Corresponding to the line of junction of the cartilages to the ribs, a sulcus on each side forms a boundary to the projection. The deformity is not inconsistent with symmetry in other parts of the chest, and the frame generally. It is equally common in both sexes. When confirmed, the heart and lungs are somewhat altered in relative position in adaptation to the figure; but their actions are not perceptibly deranged. The deformity is more frequently observed in the young, from six to twelve years of age, than in adults; which leads to the inference that patients commonly outgrow it.

Causes. The writer has not found, in any work treating on the subject, a satisfactory explanation of the mode in which pigeon-breast deformity is produced. A view that appears to solve the problem was suggested to his mind when observing the movements of the chest in a child labouring under dyspnoea with impending suffocation, and for which tracheotomy had to be performed. The patient had previously a flat chest, of ordinary shape. By the stethoscope it was ascertained that scarcely any air entered the lungs. What chiefly attracted notice was the imperfect manner in which the thorax underwent expansion at each act of difficult inspiration. The clavicular and upper sternal regions were protuberant and fixed; the respiratory movements were confined to the lower three-fourths of the thorax. But instead of the ribs which moved dilating to their full extent when inspiring, their external ends were drawn inward. And as that sinking took place along the line of junction of the costal cartilages with the ribs, from the third or fourth downward, and chiefly near the lower margins of the chest, a depression of the antero-lateral regions was the result. Now the appearance thus presented resembled so greatly the falling-in of the ribs, and protrusion of the sternum, seen in pigeon-breast deformity, that the conditions seemed identical. The constriction disappeared at each act of expiration. Thus, contrary to normal breathing, a partial contraction of the thorax occurred at every in-

spiration, and a partial expansion at every expiration. Similar phenomena have been frequently observed since.

Taking into view the great flexibility of the walls of the chest in childhood, it may be understood how they should be subject to imperfect expansion, in the manner described above, when the air, through any cause, is prevented from fully distending the lungs. In the act of inspiration two distinct operations are performed: first, to create a tendency for a vacuum, the thorax is expanded; next, the weight of the atmosphere causes air to enter the lungs. By the free admission of that air into the interior a balance is established between the pressure of the atmosphere on the outside, and that on the inside, of the chest; consequently, although the parietes may be thin and pliant, their movements can be performed with perfect facility. But quite a different state may be expected when the expansion of the chest is unaccompanied with a corresponding dilatation of the lungs. For example, in the case of a child whose larynx is closed so as to impede the entrance of air, it is obvious that, if the thoracic walls could be expanded, there would be nothing to counterbalance the weight of the atmosphere without. In such cases the chest is incapable of being expanded, or it is expanded imperfectly. To the best of their ability the intercostal and external accessory layer of respiratory muscles elevate and widen the area included within the sphere of the ribs; the diaphragm also acts on the free margin of the chest, downward and concentrically, to increase the vertical diameter; but the pressure of the atmosphere interferes with their effect. And that pressure from without tells mostly on the weakest parts of the compages. These are, unquestionably, situated in the line of junction of the costal cartilages with the ends of the ribs. Accordingly, it is there that the chest is principally indented; and this indentation leads to the sternum being abnormally protuberant.

Taking these observations into view, they show that, when the chest, as in childhood, is highly flexible, any cause that obstructs the entrance of the air into the lungs may lead to changes in its figure resembling pigeon-breast deformity. In the example which has been given, the source of the difficult breathing was of a kind to threaten life. But it can be conceived that a cause acting in a similar manner, yet of relatively slight importance as regards health, might imperceptibly, and after a considerable lapse of time, bring about an identical condition of the chest. If a child suffer from chronic enlargement of the tonsils, the encroachment of the glands on the glottis may diminish the calibre of the tube to such a degree that the air will enter with difficulty, so as to fill the lungs incompletely; and the long continuance of the dyspnœa thus produced may lead eventually to the chest becoming of the pigeon-breast shape. This idea is supported by a remark of Dupuytren's, that patients with this deformity are frequently found to have suffered at one time from enlarged tonsils.* The writer had under his care a boy, three and a half years old, in whom both tonsils were so large that they gave rise to dyspnœa, aggravated at nights so as to threaten suffocation. The air entered the lungs imperfectly; and it was remarked that the front of the chest was gibbous. The glands were almost beyond sight, having been propelled downward, as it appeared, from getting within the grasp of the constrictors of the fauces. Some days after a partial excision, the patient nearly expired in a fit of suffocation, and was restored by tracheotomy. Subsequently the tonsils were effectually removed, and the patient perfectly recovered. It was then particularly noticed that the front of the chest subsided to its natural level, and that all appearance of deformity was effaced. Further observations may, perhaps, show that other morbid changes, capable of interrupting the entrance of air into the lungs, have the effect of producing the gibbosity.†

* *Répertoire d'Anatomie et de la Physiologie*, tom. v. p. 112.

† See a paper on "Deformity of the Chest from Dyspnœa," by the writer, in *London Med. Gaz.* Oct. 1841.

Treatment. Having stated that pigeon-breast deformity exhibits a tendency to spontaneous cure, it may suffice to refer briefly to certain measures which will, perhaps, assist nature in her work. A truss, like that worn for umbilical hernia, has been found of service; or the patient, in addition to wearing the truss, may be directed to lie for several hours daily, at divided times, flat on his back, having a bag of shot, of suitable weight, laid on his breast. Most benefit, however, is to be anticipated from athletic games; and rowing may be specially mentioned.

ALEXANDER SHAW.

ON HECTIC AND TRAUMATIC FEVER, AND ON THE TREATMENT OF CASES AFTER OPERATION.

HECTIC FEVER.

THE word 'hectic' owes its origin to the Greek adjective *ἐκτικός*, formed by the addition of the termination *-ικός* to the verbal adjective *ἐκτός*, derived from *ἔχω*. The substantive *ἔξις*, derived from *ἔχω*, is commonly translated 'habit;' but it expresses rather a permanent or abiding state; *ἐκτικός*, therefore, denotes something habitual, or rather a permanent or abiding state. Thus 'hectic' in conjunction with the word 'fever' serves to designate a permanent or abiding state of fever.

Definition. Any enduring local disease, which, directly or indirectly, prevents the due nutrition of the body, or causes greater expense of the nutritious elements of the blood than can be maintained by the system, will give rise to the hectic state. The condition of the system produced by the saproscopic influence of profuse protracted suppuration is the most illustrative, and the one most frequently seen by Surgeons. It is far from being the only cause; but so commonly is the state the result of suppuration, that by some it is frequently denominated the "suppurative fever."

Symptoms. The first symptoms of hectic creep upon the patient insidiously. He begins to lose flesh. The pulse becomes variable in frequency and force, quickening on the least exertion or emotion. The skin is dry during the day, and towards evening it becomes drier and hotter, and the patient complains, perhaps, of the subjective sensation of chilliness. The face becomes a little flushed, and the palms of the hands and soles of the feet feel dry and burning. If the patient falls asleep in this state, when he awakes he finds that he has been sweating, and the latter is out of all proportion to the previous chilliness and dry heat. He is able to sleep tolerably well during the night, and in the morning there is some remission of the symptoms. His appetite is but little altered, and in the intervals between the exacerbations the tongue remains clean, indeed morbidly red and clean and smooth. In this early stage there is generally a tendency to constipation of the bowels, and in the intervals between the sweatings the urine remains clear, though not abundant. In the second degree, the emaciation is more noticeable. The evening exacerbations and morning remissions are more than ever characteristic of the state of the system. The pulse daily loses power, and increases in frequency. The tongue is smooth and glazed and morbidly clean. At the same time the patient is anxious for food, and often takes it with a relish. He sleeps tolerably well during the night, though the apprehension of the profuse sweatings may make him dread falling asleep. At this stage the bowels are often loose, and the urine becomes scanty, and deposits on cooling. In the evening there is exacerbation of the symptoms, during which the skin becomes hot and dry, the pulse quickens, and the tem-

perature of the blood runs up as in the cold stage of an ague, and the sufferer complains of the subjective sensation of chilliness. During the night the temperature slowly declines, the sensation of chilliness gradually subsides, and towards early morning, when the sufferer, perhaps, has fallen asleep, a most profuse sweat bedews the skin and drenches his clothes. It is out of all proportion to the previous chilliness. Whilst the temperature is rising through what is called the cold stage, the patient complains of the burning sensation in the palms of his hands and soles of his feet, and the cheeks exhibit the florid circumscribed suffusion which is called the "hectic flush." After the sweatings, the urine will be found to contain increased quantities of urea, chloride of sodium, sulphuric acid, and water. The chills and sweats of different degrees may occur several times in the twenty-four hours, but more particularly recur in the evening towards five o'clock. Meanwhile the patient's intellect remains quite unimpaired; indeed, sometimes the mind seems preternaturally clear and calm. In the third degree we find the patient suffering from the combined influence of the local disease and the colliquative effect of the exhaustive sweatings. The pulse becomes more and more feeble and rapid. The tongue, though it remains moist in the absence of febrility, becomes sore and covered with aphthous spots. The appetite begins to fail, and becomes capricious. The skin, in the intervals between the sweats, is dry and harsh from branny scales. The legs may get œdematous. The motions are frequently loose, and, as dissolution is approached, are passed involuntarily. The urine becomes scanty, high-coloured, and offensive. Chills and sweats succeed each other as before, but at shorter intervals; and the sweatings are so profuse and exhausting as to be called colliquative. Still the nervous system remains exempt from participation in the general wreck. The mind is perfectly clear, and in the intervals between the paroxysms the sufferer obtains a tolerable amount of sleep. The emaciation becomes extreme, and, probably, bed-sores are added to the list of deleterious agents. Finally, the patient becomes unable to take nourishment of any sort, and he subsides into a state of unconsciousness, which is the sure precursor of approaching dissolution. The pulse and respiration become fainter and feebler, and so gradually and gently does death take place, that a bystander could scarcely tell when the sufferer ceased to live.

The duration of hectic depends very much upon the nature and extent of the local disease. If a case of very extensive suppuration were allowed to progress unchecked in any way, dissolution would speedily be the result; but when the local disease proceeds but slowly, as in *morbus coxarius*, the course of the hectic may be extremely protracted.

The symptoms of hectic, so long as the primary cause continues uncomplicated with any other, are subject to but little variety. The pulse is at all times frequent and weak; the chills, exertion, and mental emotion only serve to increase the rapidity, or render it flickering, for the time. Towards the evening exacerbation, it will always be found getting more rapid than it was during the morning remission. When the tongue is found otherwise than smooth, clean, and glistening, the cause for the different appearance will be found to be due, perhaps, to some irregularity in the administration of nutriment, to the occurrence of an exacerbation, or the imminence of some complication. Constipation of the bowels is of frequent occurrence in the course of hectic, and probably this state is owing mainly to the rapid re-absorption of the intestinal secretions. In the last stages of hectic, diarrhoea is commonly met with, and in the absence of tubercular disease may be attributed to the same cause as the colliquative sweatings. The chills and sweats which have been mentioned as constant accompaniments of hectic range in degree from the mere sensation of slight chilliness to paroxysms which seem to threaten the extinction of the little power remaining to the sufferer. The phenomena of a well-defined paroxysm in hectic would, if produced in the direction of intensity, be quite similar to the shivering fits of ague, pyrexia, or pyæmia. There is the same cold stage, during which the temperature, notwithstanding

the subjective sensation of cold, is steadily rising; the same hot stage, at which the temperature has reached its height; and the same sweating stage, through which the temperature declines, and the urine is relieved of the superabundance of urea, chloride of sodium, and sulphuric acid, which had been collecting during the preceding stages. Hectic, however, should never be confounded with any of the above affections, as in every other respect, etiological and symptomatic, hectic widely differs from any of them. The only instance in which it becomes very difficult to distinguish the rigors of hectic from those of pyæmia is in the supervention of pyæmia upon hectic itself. The remarkable freedom from head-symptoms in hectic is a circumstance which should not be overlooked in any review of the phenomena of the affection. The intellect remains clear and bright from first to last. There is no infection of the blood in hectic, as in fevers properly so called; and it is only when hectic becomes complicated with pyæmia, erysipelas, or other accidental disease, that the brain gives occasional manifestations of functional disturbance and malaise.

Etiology. Any enduring local disease which, directly or indirectly, prevents the due nutrition of the body, or causes greater expense of the nutritious elements of the blood than can be maintained by the system, will give rise to the hectic state. The causes, then, must be various; but they may be divided into two groups: in the first we place any severe enduring local disease affecting an organ of the body; and in the second, any protracted disease of a non-organic part of the body. In the first of these groups we find certain diseases of the stomach and mesenteric glands interfering with the due nutrition of the body, phthisis, empyema, diabetes, abscess in the liver, disorganisation of the kidney from calculous disease, tumours of the uterus, ovarian disease, disease of bladder and kidney consequent upon stricture of the urethra or calculous disease. Out of the second group the Surgeon derives the greater number of cases of hectic which come under his care. In this group are classed diseases of the joints, attended with profuse suppuration; diseases of the bones, accompanied by much suppuration; psoas or lumbar abscess; extensive suppuration from injured parts, as lacerated and contused wounds; and any local disease which is calculated to sap away the powers of the patient.

Pathology. Hectic fever does not arise from the introduction or absorption of any foreign element or materies morbi into the blood, as is the case in contagious and specific fevers, such as typhus, typhoid, and scarlet fevers, small-pox, &c.; and it does not consist of the systemic participation in a local inflammation, as in inflammatory fever; but hectic fever arises when a local disease either obstructs the supply of albuminous elements to the blood (as in certain diseases of the stomach and mesenteric glands), or when the local disorder (as in suppurations, &c.) is the seat of an outfall from the system of the albuminous or nitrogenous elements of the blood, in quantities exhaustive of the powers of the sufferer. By this theory of the pathology of hectic, it is easy to explain the intrinsic phenomena of the affection; the loss of weight, the emaciation, the state of the excretions, and the freedom from head-symptoms. When we consider the nature of the local discharge in hectic, and the metamorphosis of tissue and consequent enormous tissue-waste which must take place during the exacerbations of the fever, we need not wonder at the rapid loss of weight, the rate at which the emaciation proceeds, and the undue quantities of urea and sulphuric acid which appear in the urine. At the same time, the immunity from head-symptoms is to be attributed to the comparative freedom of the circulation from the presence of any of the effete products of the said metamorphosis. The evening exacerbations, which are commonly observed in the specific fevers as well as in hectic, must have their explanation in common with the like phenomena in those fevers; and probably their explanation is involved in the yet hypothetical cyclical changes of the tissues of the body. The chilliness accompanying the exacerbations in hectic is to be looked upon rather as a phenomenon of the exacerbations themselves, than as a symptom proper to the hectic. Without augmentation of the tem-

perature of the blood it does not occur; and it is more or less marked in proportion to the height the temperature reaches, and the rapidity of the augmentation. It would appear to be entirely a subjective phenomenon, and produced by the state of the peripheral nerves and capillary vessels, which transmit to the sensorium the comparative condition of the peripheral parts. Hectic, at one time, was imputed to the absorption of pus into the circulation; but so well is pyæmia understood at the present day, and so fully has it been described in another place in this work, that we need not take up space here to adduce the many conclusive arguments against there being any kind of relation between the two affections.

Treatment. The treatment consists in the cure of the exciting cause, or its removal. If the local cause is such that its cure or removal is impracticable (as in certain organic diseases, and psoas or lumbar abscess), then the treatment can only consist of general palliative measures. But if the local cause can be removed, the removal should be effected immediately. It is evident that the hectic will not subside so long as the local cause shall exist. Thus, to mention one or two instances by way of illustration, if a joint is undergoing disorganisation from the presence of a sequestrum of bone, that sequestrum should be removed by operation; or, if the hectic is produced by carious disease of the articular ends of the bones, the joint itself should be excised; but if the limb be the seat of some incurable disease, such as disorganised joint from traumatic inflammation, or extensive suppuration after contused and lacerated wound, the limb should be amputated. Before, however, such an important step is decided upon, the Surgeon should have satisfied himself that no alternative is left him, and that he has exhausted all the resources of the healing art. Great judgment should be exercised in the discrimination of the time for resorting to such an operation as amputation; for although patients previously in an extremely exhausted condition have often rapidly recovered after the removal of the local disease; yet many have been temporised with for so long, that neither operation nor any future treatment have availed to save them from death.

The general treatment of hectic must be principally directed to maintaining the strength of the patient. Nourishment must be freely though carefully given, regard being had to the periodicity of the exacerbations and to the diarrhoea. Patients should never be allowed to go for any length of time without nutriment, and the latter should never be given in large quantities at once. Meat, concentrated essence of meat, eggs, isinglass, and other nitrogenous substances should be the articles of diet chiefly preferred. Stimulants should be given judiciously. They are not so urgently required in hectic as in some other affections. Enough should be given to maintain the patient's circulation, but they should never be deemed of more importance than nutriment. The evening exacerbations and sweats should be prevented, if possible, by doses of quinine, sulphuric acid, and iron, well timed before the hour at which they may be expected to recur. These remedies are most useful in checking the exacerbations and sweats, and therefore we recommend them; but beyond these, only occasional doses of medicine should be employed, to control diarrhoea or procure sleep. Pulv. kino comp. will be found the most useful in the diarrhoea, as it tends to check the sweating as well as the discharge from the bowels. Sulphuric acid alone is powerless to check the diarrhoea. Diarrhoea, from tuberculous disease or from errors in diet, must be combated by the appropriate remedies ordinarily in use for such affections. In all cases in which hectic is likely to last for any length of time, we strongly recommend that the sufferer should be early put upon a water-bed, and that every device for preventing bed-sores should be resorted to. Finally, with regard to those instances in which amputation seems the only remaining alternative, we would impress upon the Surgeon the impropriety of wasting valuable time in vain attempts to stave-off the evil day. "True clemency does not consist so much in delaying strong and vigorous measures, as in boldly deciding to put them in execution as soon as they are indicated."

References: Hunter on Inflammation; Dr. Parkes's Gulstonian Lectures on Pyrexia, *Med. Times and Gaz.* vol. x.; Dr. Sidney Ringer on "The Connexion between the heat of the body and the excreted amounts of urea, chloride of sodium, and urinary water, during a fit of Ague," *Med.-Chir. Trans.* vol. xlii., and "Cycles in Disease and Health," *ib.* vol. xlv.; Cooper's *Surgical Dictionary*; "On Inflammation,"—Mr. Simon, *System of Surgery*, vol. i.

TRAUMATIC FEVER.

Definition. Traumatic fever is that species of inflammatory fever which is produced by the one constant cause implied in its particular denomination: in other words, the febrile condition which, as a general rule, rapidly follows the infliction of a wound of any magnitude, is called traumatic fever.

Symptoms. As in inflammatory fever, so in traumatic, *pari passu*, with the augmentation of the temperature locally, that is, at the seat of the wound, the temperature of the mass of the blood rises, and the phenomena of general febrility manifest themselves. Thus, the pulse becomes quick and perhaps sharp. The patient gets restless. The skin grows hot, and feels dry to the touch. The face is flushed. The excretions are correspondingly altered in character; the urine is scanty, high-coloured, and saline, and it is said, at the same time, to become remarkable for the absence of its chlorides. The feces are often retained, and when passed are dark-coloured and offensive. The tongue is foul and furred. Towards evening the temperature of the blood augments, and simultaneously the symptoms undergo some exacerbation. With the advance of these usual accompaniments of febrility, the restlessness is apt to increase; and when the patient falls off to sleep, his rest is troubled and unrefreshing. During the first few hours, whilst the temperature of the blood is mounting up, the sensation of chillness is commonly to be observed; and when the heat mounts up very rapidly, distinct rigors may occur. But it seldom happens that the milder forms of traumatic fever are ushered in by rigors such as occur in the specific fevers. Supposing the local inflammation to pursue a normal course, the signs of general febrility commonly begin to decline about the third day, and have subsided altogether by the seventh day, unless some complication has occurred to produce a secondary state of febrility. Day by day the rapidity of the pulse declines, and becomes a better index to the powers of the patient; the heat of skin subsides; the tongue cleans and gets moist; the excreta acquire a more healthy character; meanwhile the restlessness subsides, and sleep becomes once more restorative.

The foregoing is a description of a well-marked uncomplicated case; but practically traumatic fever is subject to considerable variety, not only with regard to the degree and duration of its symptoms, but also with regard to result.

Duration. First, as regards degree and duration. Many injuries and most minor operations are not followed by any perceptible degree of systemic febrility; such injuries as simple fractures and dislocations, and such operations as amputations of fingers or toes, excision of eye or cancer of lip, circumcision, &c. Dr. Billroth, who has published some interesting original researches on traumatic fever, states that in 77 cases of injury and minor operations which he watched, he did not detect any fever at all. In proportion, however, to the severity of the injury, and the more or less acuteness or extent of the local inflammation, traumatic fever will vary in the mildness or intensity of its symptoms. Under favourable circumstances, it may end in a few hours from its commencement; but in most cases, whether of injury or operation, the fever lasts from two to seven days. When it lasts as long as from five to seven days, it is generally in robust subjects who have sustained severe injuries; and when it lasts more than seven days, the prolongation is generally due either to the traumatic merging into suppurative fever, or to

inflammation, consecutive and therefore secondary to the first, and probably there has not been any interval of time between the two.

Result. The result of traumatic fever must necessarily be subject to great variety of circumstances. It may end healthily any time from two to seven days; but, on the contrary, it may be subjected to the influence of some peculiarity in the condition of the patient; it may get complicated with some accidental disorder, or be succeeded by a more or less violent secondary fever. Old age or intemperate habits may so injuriously modify both the course of the traumatic febrility and the local inflammation, that both locally and generally the patient may exhibit such signs of want of reparative power, that little hope of his ultimate recovery can be entertained; he may sink without any reaction. Again, the presence of some organic disease, such as fatty disease of the liver, or granular disease of the kidney, may, in a similar way, influence on the one hand the course of the local action, and therefore of the general febrility; and on the other hand render the patient more liable to some complicative secondary disorder, such as erysipelas or pyæmia. The precise extent of the influence of waxy disease of the liver, kidney, or spleen, has yet to be defined; but in those instances which have come under our own observation, the traumatic febrility after operations has not exhibited any unusual features. The accidents which are likely to occur to complicate the state of febrility are erysipelas, retention of the excreta and the retention of serum, clots, or foreign bodies in the wound. Should a patient remain feverish after the seventh or eighth day, or recommence to be feverish after he has once been free from that state, a secondary cause must be sought for. In by far the greater number of cases this cause will be discovered to be a local one. In the milder forms it may have proceeded from either the extension of the inflammation to neighbouring tissues, the slow separation of a slough of fascia, or the formation of some deep-seated collection of pus; whilst in the severe acute cases, the secondary fever will be found to have arisen from correspondingly grave causes, such as the septic poisoning of the blood (septicæmia) by putrid fluid from the locality of the injury, or the occurrence of that scourge of hospitals, pyæmia. Thus it will be seen that the period of decline of the traumatic febrility is the time at which the patient is most exposed to secondary affections, such as those just mentioned; and this period, therefore, should be watched by the Surgeon with undiminished vigilance and care.

Treatment. If the Surgeon has already made himself thoroughly acquainted with the principles on which inflammatory fever and local inflammation should be treated, by careful study of Mr. Simon's essay in the first volume, he will have no difficulty in comprehending how cases of traumatic fever should be managed. In the same way that local inflammation and inflammatory fever stand to each other in the relation of cause and effect, so wounds and traumatic fever depend the one upon the other. The subject of treatment, therefore, is naturally resolved into local and general. Presuming that the wound has already given rise to general febrility, the first remedial step should be a local one, viz. to place the wounded part in that position which will simultaneously control the circulation to and from the seat of injury, favour the drainage from the wound (if there is any), and be most agreeable to the patient. Cold is the next local remedy which should be employed. Cold, judiciously applied, is a most powerful agent in restricting the degree and extent of local inflammation by the abstraction of heat, and it follows that it must necessarily exercise, through its local agency, a certain measure of influence over the intensity of symptoms of general febrility; hence much stress is laid upon its use. Ice, enclosed in waterproof bags, should be spread over the wound and its neighbourhood, and an especial attendant should be employed to see that the application is never intermitted, even for a minute. If ice is not to be had, cloths wetted with very cold water should be kept constantly spread over and around the wound, or glass vessels containing cold water may be kept applied in a similar way. A com-

prehensive account of the local treatment required by the various kinds of wounds is not within the province of this essay, which only has to deal with the wound so far as the latter is connected with traumatic fevers; and for the various modes in which wounds and injuries are to be treated independently of traumatic fever, I must refer the reader to the essays on WOUNDS, FRACTURES, &c. The general treatment should be quite simple, so long as there is freedom from complication; rest, limited diet, and attention to the secretions, being all that is necessary. In the severer forms in robust persons, when the pulse is strong and full, or when inflammation of some vital organ contiguous to the injury is threatening, it may be necessary to employ febrifuge remedies, as topical bleeding, antimonials, or laxatives; but as a general rule, absolute rest, abstinence, and a purge in the case of constipation, are all that are required in addition to the local treatment. It can only be in a very few and exceptional cases that abstraction of blood is necessary; as for instance, in wounds of the lung from fractured ribs. In aged subjects, and those who have suffered extensive injuries or operations, notwithstanding symptoms of febrility, the powers must be aided or maintained by stimulants; and to those who have been accustomed to much wine and beer, or to take opiates, sedatives should be administered unhesitatingly.

When the febrility has been *renewed* by any cause, local or general, the local and general treatment will require to be modified to meet the exigency of the particular case. If the wound has become the seat of fresh inflammation, it must be examined for retained foreign bodies, and provision should be made for the escape of clots, serum, sloughs, &c. Fresh collections of pus should be at once evacuated. The use of cold should be carefully kept up, and even extended, where inflammation is spreading to contiguous tissues, and its use should not be intermitted until suppuration has begun to diminish. In the general treatment, care should be taken to correct any retention of the excreta, and complications, such as organic diseases, erysipelas, septicæmia, pyæmia, delirium tremens, or tetanus, must be met by suitable and appropriate remedies.

References: Mr. Simon on Inflammation; Mr. Paget's Lecture on Treatment of Wounds; on Fever accompanying Surgical Affections, Dr. Billroth (Berlin: Hirschwald); or Abstract in *Year-book of Sydenham Soc.* 1862.

MANAGEMENT OF PATIENTS AFTER OPERATIONS.

Owing to the many beneficial modifications and improvements which have been effected during the last three hundred years in general as well as operative surgery, there is no branch of our art which has undergone more amelioration than that of the "Management of Patients after Operations." And we may felicitate ourselves all the more, that these changes, agreeably with all genuine progressive amendments, are in the direction of simplicity and soundness.

If we briefly delineate the state of things after a severe capital operation performed three hundred odd years ago, the student of the present day will then perceive how much room there was for improvement; and at the same time he will be better able to appreciate the changes which must have been accomplished ere we could have arrived at the simple and sound after-treatment of our own time. Take, for instance, amputation of the leg. The poor sufferer has had the soft parts of his limb severed to the bone by one deep circumcising sweep of the knife, the bleeding vessels have been broadly seared with the actual cautery by no sparing hand; and shocked and agonised as he is by these preliminary steps, there only remains to him the dismal certainty (should he recover the shock and hæmorrhage) that his poor burnt and painful stump must undergo all the tortures of casting off its charry sloughs through a tedious course of emplastrics and agglutinatives, caustics and re-percussives, detersives or mundificatives, ere it can be pronounced to be at its best a tender cone of thin-skinned granulations.

On the contrary, at the present time, thanks to the numerous advances and discoveries which have accrued upon the extended use of the ligature (for which we are indebted to Ambrose Paré, A.D. 1535), and the subsequent development of the process of union by primary adhesion, we can now boast that our patients may contemplate operation without dread, may undergo its performance with the very minimum degree of shock, and may recover from it tranquilly, speedily, and almost painlessly. In order, however, to accomplish so much as this, many precautions and much care must be taken, both with respect to the wound and the patient; and these pains are required, not so much in elaborating and doing a great deal, as to keep at a distance all the evils and mischiefs which might interfere with the simple and natural process of repair. We cannot impress it too strongly on the Surgeon that, in his after-treatment of operations, his business should be to keep jealous guard over the simplicity of the reparative processes of nature. "And let it not be thought that thus limiting our office in the ordinary charge of patients after operations to the mere 'watch and guard' of natural processes, we diminish or degrade the true value of our calling. The obstetrician has not done so in giving up all the 'meddlesome midwifery' of former times; and certainly that branch of our profession was never more honoured or more useful than now, when, in all ordinary cases, it limits its duty to the superintendence of the sufficient work of nature. Similarly, Surgeons may stand by and watch; content to shut out mischief (always a difficult task), well content if they can do that which is much more difficult—control the restlessness of popular or half-taught ignorance, which, in its audacity or its fright, would be for ever busily trying to improve the perfect ways of nature. Both these are difficulties; but if we are ambitious of more, we find only too soon that, easy as the task may seem when all goes well, the utmost strain of all our knowledge and of all our mental power is not too much for the difficulties that may arise in an untoward case."^{*}

After an operation, the first care of the Surgeon should be to close the wound well. We presume that it will be his desire to get the wound healed as much as possible by primary union; but in the execution of this very proper design, the Surgeon must at once make up his mind to be cautious and circumspect. If he attempts to get as much primary union as possible, without regard to the nature of the wound, he may not only in part fail, but probably will entail the sacrifice of immediate union through the whole extent of the wound, and therewith his first difficulty will have commenced.

In wounds of depth and intricacy, such as those made in the removal of exostoses and some deeply attached tumours, and in wounds communicating with cavities, such as those after herniotomy, lithotomy, removing sequestra of bone, and those made by amputating through abscesses, and in similar wounds, it would be positively mischievous to close the wound entirely and attempt to get primary union. The Surgeon has the choice at first of securing complete primary union, partial union, or of leaving the wound to heal by granulation: let him be discreet in choosing which degree he will attempt to achieve, for the future management of his patient will be very much simplified by his pursuing that course which will leave him nothing he may have to undo. Whilst on the subject of closing wounds, we will take leave to extend our remarks to a topic intimately connected with it, viz. securing the bleeding vessels. We strongly advise that all bleeding should be stopped before the wound is closed; and that, either by acupressure or ligature, every bleeding orifice should be compressed, and the wound finally closed before the patient is removed from the operating-table. There are some wounds in which, for a short time after operation, owing to faintness or shock, it must remain uncertain whether any more bleeding will occur; in such, of course, the wound must be allowed to remain open; but it should be

* Paget, *Address on Surgery*, London, August 1862.

closed as soon as possible after reaction has fairly passed its height. As a rule, to revisit and disturb patients some three or four hours after operation (as amputation) in order to close and dress the wound, is a practice as cruel as it is unnecessary. Attention to details such as these will diminish the risks of future difficulties more than some are inclined to admit.

In "dressing" the wound for the first time, or indeed at any time, the Surgeon should think rather of how little than of how much he must take upon himself to do, and of how little he need interfere with the natural reparative processes. Let him be content to put as little dressing about the wound as possible. He had better put nothing at all than too much, especially to wounds which must heal up from the bottom. If the sutures hold the edges of the wound accurately together, in the instances of those wounds which are to heal by primary union, any farther means of contact should be rejected as unnecessary. Support should be given to the vicinity of any wounded part which may be subjected to movements tending to interfere with its perfect repose; for instance, after ovariectomy, resection of a joint or the stump after amputation; but the bandaging and pillows must not be allowed in any way to obstruct drainage from the wound (if any be likely to occur), or prevent the preservation of perfect cleanliness. Perfect repose and perfect cleanliness are most absolutely necessary adjuncts to the local management; and if these are not preserved from the outset, all the care which has been bestowed on the starting of the case will have been thrown away. For the preservation of local repose, all unnecessary movement of the wounded part must be strictly prohibited: if our advice be followed with regard to simplicity in dressing the wound, the part need be but little disturbed on account of strapping and bandaging and cleansing. Cleanliness throughout the local management cannot be too strongly insisted upon: it is not enough to remove dressings as they foul, and pools of discharge when they have collected, but the soiling of the dressings and any collections should be *prevented* by careful drainage from the wound and the liberal use of such antiseptics as vegetable charcoal, Condyl's solution, or the chlorinous washes. Local bathing should be employed whenever practicable, especially in perineal cases; and, in short, any thing that can interfere with perfect cleanliness about the wound or the bed, or with free ventilation, which must ever be associated with cleanliness, should be most studiously avoided. With regard to the application of ice or cold, either should be avoided, on the principle of interfering with natural processes as little as possible, unless it be specially called for by traumatic fever or the threatening of recurrent hæmorrhage.

Sutures should not be removed in accordance with any fixed rule, but rather at discretion: so long as they are innocuous in the wound, and yet of service in keeping edges together, let them be retained, for they will serve for a short time longer instead of messy plaster.

The final removal of ligatures should generally be deferred until they have evidently loosened from their holds. In the rare instances when they remain fast on beyond the usual time, traction should be repeatedly applied until their hold has at last given way. Were ligatures always tied as tightly as they should be, accidents with them would happen even more rarely than they do.

Before leaving the subject of local management after operations, we must not omit to refer to the necessity for constant watchfulness to detect and promptly evacuate any deep-seated suppuration or secondary abscess, nor must we fail to remind the Surgeon that it is his business to be ever on guard against the supervention of some secondary affection or complicative disorder.

In the "general treatment," simplicity should be the one thing aimed at as much as it has been recommended in the local. The room, or portion of ward, in which the patient is to live should be kept scrupulously clean and ventilated. All unnecessary bedding and bed-furniture should be strictly prohibited. His bed should be so prepared with regard to its sheeting and covering that changes may be made without disturbing or moving the patient.

himself. In some operations, such as those for ovariectomy, lithotomy, herniotomy, &c., it is of the utmost importance to adopt some special plan for facilitating the changing of the bed-linen, and indeed the body-linen, of the patient. His personal cleanliness should also be attended to with the most scrupulous care; his linen should be frequently changed, at least as frequently as he will bear the necessary moving and exertion; sponging and bathing ought to be copiously performed, not only for general, but also for local purposes, especially after such an operation as section of the perineum for extravasation of urine. Excreta should be methodically carried away from the patient's room as soon as passed. His room should be kept well ventilated at all times; and when convalescent, he would benefit by being removed, if possible, to another room, or even to another part of the ward. With regard to diet, we would specially have the Surgeon on his guard against falling into any extreme. It by no means follows as a matter of course, that because a patient has undergone operation and has lost blood, more stimulants and more nourishments are to be added to his dietary; and, on the other hand, it would be as great an error suddenly to cut him down because he has just been relieved of some consuming disease, or because of some vague fear of "inflammation." The Surgeon must not act by rule, but he must proportion the dietary to the present exigencies of the case. After by far the greater number of operations on the surface of the body or the extremities, the inclination of the patient may be trusted as a safe guide; he may be allowed to take solid and fluid nourishments as near in quantity and quality to those to which he has been accustomed, as his altered appetite will permit. Proportionate allowance must be made in case his appetite has been exceptionally indulged; and should our patient have been accustomed to take excessive quantities of stimulants up to the time of operation, we must be careful so to proportion a supply of the usual stimulants, that he shall neither suffer from their absence nor feel their presence. Occasionally it happens that amputation is performed in the midst of the course of hectic, and at a time when the sufferer is taking very large quantities of stimulants and nourishment; it would be highly injudicious in such a case to continue the stimulants at the previous rate, and it would be equally an error to withdraw them suddenly; they should be gradually diminished, commencing from the day after the operation. After operations involving peritoneal or mucous membranes to any extent, there is more reason for instituting rigid daily surveillance over the patient's dietary; for transgression beyond light, unstimulating, and nutritious articles of food and drink may prove of the gravest importance. Besides these foregoing very important subjects—of cleanliness, ventilation, and diet, which concern all operation-cases without exception—there are some special *symptoms* which occasionally arise as immediate consequences of the operation or the action of the anæsthetic. The events which we most frequently meet with are shock or faintness, sickness from chloroform, retention of urine, and pain or restlessness.

Shock, purely the result of the mutilative part of an operation, is rarely, if ever, seen at the present time, when the benefits of chloroform are so very generally made of avail. But there occasionally happens from the combined effects of operation, loss of blood, and chloroform, such a faintness, a *deliquium* so threatening, that the condition is quite as alarming as shock itself; and the worst of it is, that but little of the warning of its approach is noticed beforehand; the patient is almost suddenly found to be in this condition, and the first impression is that too much chloroform has been administered. The faintness, however, continues long after the chloroform has been discontinued, and reaction follows but slowly. In the treatment of this condition great caution should be observed, the impulse being to instantly begin an overflowing administration of brandy and stimulants. Stimulants must be given, and brandy is the one most to be preferred; but it should be given at intervals, regulated by the state of the pulse; as the effect of the preceding dose seems to subside, the next should be given, and so on, at gradually in-

creasing intervals, until at last the signs of reaction have become steady and secure, when the remedy should be discontinued. The administration of nutriment may be recommenced when reaction has set in, but they are worse than useless during the first period of the faintness; for their simultaneous ingestion with the brandy or stimulant most frequently provokes vomiting, and entails the awkward necessity of temporarily suspending the brandy.

For further and an exhaustive account of the particulars of shock, the student may refer to the essay on "Collapse" in the first volume.

Continued sickness from the chloroform is another symptom, which may happen after operations; and when it does occur, it not only complicates or increases any faintness there may be, but it sadly interferes with the repose, and jeopardises the primary union, of the part operated on. The mischief of its occurrence would be so great in some cases (as cataract extraction, &c.), that the anæsthetic advantages of the chloroform have altogether to be pretermitted. It is of great importance always that the sickness should be checked as soon as possible, and especially when it is a co-evil with shock; but, unfortunately, it is not by any means easy to cure. It must be remembered that the sickness is but one symptom of many which belong to the same cause: the depressed action of the heart, the pale skin, the extreme languor, and the sickness own one and the same cause (though that cause may possibly be the compound one alluded to in the remarks on shock). The treatment, therefore, should be of sufficiently general character to answer the double purpose of maintaining the circulation and composing the nervous system, especially the cardio-gastric. There is no medicine, nor is there any specific for it. If left alone, the stomach will recover by itself, though the sickness may last over many hours. The patient should be kept absolutely quiet and reposed; the attendant should be forbidden to plague him with frequent interruptions in order to give stimulants or drink. A teaspoonful of brandy may be given occasionally to maintain the circulation, and he may be allowed to suck small pieces of ice at intervals. Nourishments only tend to increase the sickness, and therefore should not be recommenced until the sickness has abated. From our experience of such remedies as morphia and opium, we cannot advise their employment; indeed, they frequently seem to do more harm than good.

Retention of urine is not an uncommon event after some operations, such as amputation of the thigh, and operations upon the rectum or other pelvic structures. It is a well-known fact, and we only mention it here, that the Surgeon may be forewarned and forearmed. Inquiry whether the patient has passed his urine or not should be made invariably in the evening and on the morning following the operation; and if necessary, the bladder should be emptied by means of the catheter. If the bladder is allowed to go unemptied, the first night after operation is likely to be a restless one.

Pain and restlessness are the other symptoms after operations which may demand special treatment. Some Surgeons make it a practice to give an opiate very quickly after an operation, in anticipation of pain, or with a view to induce sleep: but the indiscriminate use of opium in that way cannot but have an injurious effect upon the patient; when its effect has subsided, he is left unmerved, restless, and all the more sensible to pain, if there be any. The use of opium should be avoided, if it is not positively indicated; for its action in blunting the patient's sensibility to unimportant impressions cannot compensate for its interference with the various functions of the body at a time when their healthy action is so necessary to due nutrition and excretion. If, however, severe persistent pain (rare enough after operations), or great restlessness, seems to demand the exhibition of anodynes, opium or morphia should be used; and one or the other should be given in full sufficient quantity, not in small, but in doses large enough to insure the induction of good sound sleep.

The only remaining subjects of importance in the "management of patients after operations" are those of traumatic fever and the disorders

which may happen as complications. But since they have been already fully described in other parts of this work, it seems unnecessary now to refer to them, farther than as the dangers and difficulties which, in his "watching" capacity, the Surgeon should ever have in apprehensive dread, and against the occurrence of which he should constantly and intelligently remain on "guard."

JOHN CROFT.

APNŒA.

THIS essay is entitled APNŒA instead of ASPHYXIA, on account of the well-known fact that the word 'asphyxia,' taken in its etymological sense, signifies an absence of pulse (α , *not*; $\sigma\phi\upsilon\zeta\omega$, *I beat*), and, as will afterwards appear, a more inappropriate term for the form of death about to be considered could scarcely be devised; the chief characteristic of this mode of dying being the continuance of the heart's action after the cessation of all other vital phenomena. To be logical, therefore, as well as philosophical in the treatment of the subject, it is necessary to abandon the word 'asphyxia,' even in spite of its familiar use, and adopt in its stead the more suitable, though less frequently employed term 'apnœa' (α , *not*; $\pi\upsilon\epsilon\omega$, *I breathe*). Even the word 'apnœa' is in some respects defective, for it fails to convey clearly to the mind the true cause of death, namely, not the absence of respiration, but the want of oxidation. As shall presently be seen, there may be no impediment to the inhalation and exhalation of air, and yet the animal dies. As the word 'apnœa' is, however, suitable to the great majority of cases, it is preferable to retain it, rather than to coin a new name, which, in its turn, might be found equally inadequate to the explanation of phenomena which may afterwards be revealed by advancing science.

The term 'apnœa' well explains the great fact, that without respiration there is no life; man's earliest declaration of independent existence being his first respiratory effort; his seal to the abdication of life the last expiratory act.

The necessity of respiration is well illustrated by the fact, that so long as animal-life continues, this function knows of no intermission. By day and by night, sleeping and waking, the lungs are ever performing their allotted labour of inhaling fresh, and expelling effete air.

Few are aware how little the respiratory function is under their own control. At the first glance many might imagine that respiration is, to some extent, a semi-voluntary process, for they can temporally arrest it at pleasure. If, however, the time men are able to cease respiring be exactly calculated, no one can fail to be astonished at its extreme brevity. Not one in a hundred can cease breathing for a single minute without suffering great discomfort; and still fewer can hold their breath for two entire minutes without yielding to an involuntary and irresistible respiratory effort. The numerous stories heard and read of persons voluntarily holding their breath for five or more minutes are simply fables. In the course of this essay it shall even become apparent that the numerous reports of successful cases of resuscitation after prolonged submersion,—such as half an hour, for example,—are pure impossibilities, originating in imperfectly-observed data. Such statements would never have been promulgated had their authors for a moment considered how frequently repeated and uninterrupted the acts of respiration are. The number of respirations is alone a sufficient proof of their necessity. If, for example, the average number of respirations is taken as low as eighteen in a minute, which is somewhat under one in four seconds, it is evident that the gases essential to the continuance of organic life are renewed one thousand and eighty times in a single hour;—figures which are of themselves sufficient to indicate how perilous must be even a very temporary cessation of the

respiratory function. Shortly, however, other reasons will be adduced for disbelieving the statements referred to. Meanwhile it may be proper to consider the

Symptoms of apnoea. The first symptoms that manifest themselves when a healthy person is deprived of air are feelings of thoracic fulness and discomfort, which gradually, but rapidly, assume the form of an intense oppression. To the latter symptom is soon superadded an uncontrollable desire to breathe, which is immediately followed by violent respiratory efforts. The respiratory efforts are at first short and recur in rapid succession. They soon become deep, forcible, and prolonged, with a gradually-widening interval between them, until just before they entirely cease, when they again diminish in force and duration. During this period, which, for the sake of convenience, may be termed that of respiratory movement, certain cerebral symptoms present themselves in somewhat of the following order: In the earlier part, the patient feels a sensation of fulness in the head and giddiness; experiences ringing in the ears, and has flashes of light dancing before the eyes. To these, it is said by persons who have been rescued from impending suffocation, succeed pleasing, almost voluptuous, dreams, which, however, soon fade away, and give place to insensibility and unconsciousness, which, in their turn, are speedily followed by convulsions and coma.

As regards the circulatory system, it is found that at first the heart's action is accelerated, partly perhaps on account of the patient's struggles for breath. This condition is but transitory; for in the space of a very few seconds its action becomes slow, laboured, and feeble, till the pulse at length ceases to be perceptible at the wrist. The heart is, however, still pulsating, and the throb may be detected by the aid of the stethoscope; the action gradually becomes less and less distinct, till it entirely ceases at a period within ten minutes after the first interruption to the respiratory process. The period that elapses between the last respiratory effort and the cessation of the heart's action may be calculated to vary from two to four minutes.

The appearance of the patient during the time just described undergoes a marked change. There is an extremely anxious expression of countenance, blueness of the lips, projection of the eyeballs, distension of the vessels of the face, head, and neck, frothy mucus, occasionally sanguineous, about the mouth, an involuntary passage of urine and faeces, sometimes even an emission of semen with or without erection. All of these symptoms are modified, and supervene with more or less rapidity, according to the mode in which the apnoea has been produced. Although apnoea may be induced in a great variety of different ways, each of which presents its own peculiarity, it is unnecessary at present to dwell upon the subject, the diagnosis of the case being in general attended with no difficulty, from the fact that its history clearly explains the symptoms. It has, however, happened that the medical attendant has been purposely misled into an error in diagnosis by the relatives of the patient, who, in their desire to protect the honour of the family, have occasionally not hesitated to trifle with the life of one of its members. It is therefore of importance to call attention to the danger, which a practitioner occasionally runs in such cases, of mistaking the cause of the symptoms, and thereby falling into an error in treatment. This can scarcely be more forcibly done than by briefly relating the case recorded by Mr. Thomas Stainthroe, which strikingly illustrates the truth of the remark.

On one occasion, Mr. Stainthroe was suddenly called after midnight to see a clergyman. On arrival he found the gentleman in bed, unable to speak, insensible, and presenting the symptoms of apoplexy. The relations heard the remarks of the medical attendant, listened to the line of treatment suggested, and assisted in its performance without giving the slightest hint as to the true cause of the symptoms, or making any allusion to the fact that the patient had, a few minutes before, been found suspended by the neck to the top of his bed. Mr. Stainthroe, in the belief that the case was one of apoplexy, opened the veins of both arms, and extracted three pints of blood

before any improvement in the symptoms took place. This was followed by other treatment considered applicable to the case; but it was not until ten hours had elapsed that the gentleman was able to answer questions; and no wonder, seeing that if the medical attendant had been honestly informed of the cause of his patient's symptoms, he might probably, with a little assistance to respiration by artificial means, have restored him in as many minutes. The gentleman recovered.*

Post-mortem appearances. The external appearances presented by individuals in cases of death by apnœa vary according to the manner in which it has been induced, as well as with the period that has elapsed between the examination and the extinction of life. If the examination be delayed for twelve hours, for example, the signs presented by the body differ but very slightly, if at all, from those frequently found in persons that have died from other causes. Positive evidence, indeed, can only be obtained in such cases by an internal inspection, and even that must be carefully made, otherwise the cause of the apnœa may escape detection. This remark is specially applicable to cases of accidental and intentional apnœa.

If the body is seen within three or four hours after death, its external surface will be found to present numerous discolorations. The lips are blue, and oftentimes covered with frothy mucus, which occasionally presents a slightly sanguineous appearance. It ought not to be forgotten that frothy, even sanguineous, mucus may be found about the mouth in other cases of sudden death besides that arising from apnœa. This is the case in epilepsy; in heart-disease; and on the very day of writing these lines we saw it in a marked degree in a case of concussion of the brain. The driver of a piano-forte van was thrown violently from his seat against a lamp-post; and on his being brought to University-College Hospital, the slightly-tinged froth around the mouth and about his nostrils was specially observed. He had been dead about 15 or 20 minutes. The tongue is often swollen and livid, and not unfrequently shows marks of the teeth upon it. This is particularly noticeable in those cases in which convulsion has preceded death. The eyelids are half open, and the pupils dilated. The countenance is generally placid, the skin of the face usually pallid, or if discoloured at all, possessing a faintly livid transparency. In cases of death from drowning, the skin has now and then been observed to present the appearance denominated *cutis anserina*; but this is by no means a common occurrence.

Rigor mortis usually sets in early; and this is particularly the case after drowning in cold water, when a state of semi-freezing has been frequently observed instantly to succeed, if not actually to usher in, death. So firmly are substances occasionally grasped in the clenched hand of the drowned, that they are only to be extracted from it by the application of great force. Cases are recorded where the finger-bones have been actually fractured during the forcible opening of the hand.

In apnœa from the external application of mechanical means, evidences of the mode by which death has been induced generally remain visible for some hours. There may be sugillation, ecchymosis, or laceration at the injured parts. There may be the mark of a cord or of fingers upon the neck. The hyoid bone may be fractured, the cartilages of the larynx dislocated; and various other evidences of mechanical injuries, according to the manner in which the apnœa has been induced.

On the other hand, it must not be forgotten that death may arise from mechanical means, and not a trace of its nature be visible to the eye. This has frequently happened in cases of smothering and plugging of the fauces or windpipe. In such cases, therefore, the existence of the apnœa can only be detected by an internal inspection.

State of the internal organs in cases of death by apnœa. We shall commence

* *Lancet*, Oct. 1, 1859.

the consideration of this portion of our subject with the brain. The cerebral vessels have by most authors been particularly noted as being engorged with dark venous-coloured blood. Great doubts have recently been thrown on the value of this sign, however, by Ackermann, who states that from the results of experiments on animals, conducted according to Professor Donders's method of rendering visible the condition of the circulation in the brain during life, it appears that death by suffocation is always connected with an exsanguine state of the cerebral vessels; the appearances of hyperæmia, so often observed, being merely the result of the post-mortem mechanical distribution of the blood. The appearances of cerebral anæmia, the author states, are even distinguishable in cases where the animal has been strangled with a cord round its neck, and the head kept somewhat lower than its body. The anæmic condition of the brain is gradually assumed after death if the head be not kept lower than the rest of the body, and it only attains to its maximum an hour or two after death. If these assertions be correct, they clearly point to the necessity of carefully taking into consideration the position of the body after death, before drawing any conclusions from the state of the cerebral vessels.

Ackermann goes so far as to say that the condition of cerebral anæmia is equally observable after death from compression of the chest, inhalation of chloroform, and injection of water into the lungs. The results of these experiments seem to explain why cerebral anæmia has been so frequently noted in cases of death by apnoea. It must not be forgotten that extravasations of blood under the arachnoid have been occasionally found in drowned persons. These were probably due to the injuries sustained by the head in falling from a height. Mere concussion with the surface of the water has been known to produce it; and it is common enough in persons who have come into violent contact with the bottom, or substances floating on the water, while diving.

Heart and vessels. Particular attention has been paid to the condition of the heart and great vessels in cases of death by apnoea. It is usual to find the right side of the organ, both auricle and ventricle, as well as the large vessels attached thereto, highly engorged with dark-coloured blood. The left side of the heart, on the other hand, is in the majority of cases found empty; or if it contains blood, the blood is of the same venous hue as that found occupying the right side of the organ. The blood throughout the whole body, indeed, is of a similar dark tint. Some state that it presents the additional peculiarity of being fluid; but this is far from being always the case. The portal system is greatly engorged. The liver, spleen, and kidneys specially partake of the venous congestion. It may indeed be asserted, in general terms, that in death by apnoea all the internal organs are more or less engorged with dark blood. Most authors have stated that the lungs are particularly so; but although we have had our attention specially directed to this point for many years past, and enjoyed several opportunities of being present at the autopsy of persons who have perished by apnoea, we are forced to admit that this is not so invariably the case as we had been led to expect.

There being no more blood in a person killed by apnoea than in one who has died from any other cause, it is easy to see that there cannot possibly be a general engorgement of the whole vascular system. If one part of the body is particularly congested, another must be proportionally anæmic. The venous system is full of blood because the arterial is empty; and the simple reasons are—1st, that the pulsations of the heart and vessels continue after the respiration and consequent circulation in the lungs is stopped; and, 2dly, the resilience of the arterial coats prevents the return of the blood into them from the capillaries. Again, as regards the congestion of the internal organs. If it be very marked, there is a corresponding pallor of the external surface. This is specially noticeable in persons drowned during the winter months, and is due to the cold causing constriction of the cutaneous vessels and driving the blood inwards.

Condition of the respiratory system in cases of apnoea by submersion. As in cases of death by drowning the lungs present appearances not to be met with

in the other forms of death by apnœa, it is necessary that special allusion be here made to them.

Some say that water never penetrates the lungs, in consequence of spasm of the glottis being induced as soon as the fluid comes in contact with the opening to the air-passages. Others again, with equal confidence, assert that not only water, but any foreign substance, such as mud, duck-weed, and chaff, which may accidentally chance to be floating in it, are carried into the lungs. Our personal experience, as well as that of the Royal Medical and Chirurgical Society's Committee,* entirely negative the former, and support the latter, statement.

Into the lungs of every animal, without a single exception, experimented upon by the committee, the fluid in which the animal was immersed freely entered. The extraordinary force by which substances are drawn into the lungs in cases of drowning was estimated by the committee, and found to be equal to the raising of a column of mercury four inches.† When dogs were drowned in plaster-of-Paris, on examining the lungs after death the white plaster could easily be detected in the minute bronchial tubes. Even in the lungs of guinea-pigs held upside down, with only the nose immersed sufficiently deep in mercury to prevent the possibility of the animal getting any air, globules of the metal were readily detected in the minute tubes, thereby proving that this weak animal's respiratory efforts were capable of drawing the mercury the distance of one or two inches in spite of gravitation. The lungs of animals drowned in pure water, when examined immediately after death, were found by the committee to be saturated and sodden with water to such an extent that they pitted on pressure, felt doughy to the touch, were exceedingly heavy, and incapable of collapsing. The air-tubes were choked up with a sanious foam, which consisted of blood, water, and mucus, churned up with the air in the lungs by the respiratory efforts of the drowning animal. On section of the pulmonary tissue, frothy water stained with blood poured out at every point.

How can this fact be reconciled with the statement so often made, that no water is to be found in the human lungs after death by drowning? We have ourselves failed to detect water in the respiratory organs of a young woman, aged 23, who committed suicide by drowning. The lungs, when examined twenty-four hours after death, crepitated readily on pressure, except in the most depending portions to which the blood and water, if there was any, had gravitated. The failure in detecting water in this case, however, did not excite the least surprise, notwithstanding our being in possession of the above-mentioned data; for we were at the same time acquainted with the important fact of the powerful absorbing power of the pulmonary tissue. It is almost impossible to say how much water may be taken into, and disappear by absorption from, the lungs during the act of drowning. It must be remembered that the extinction of life in cases of submersion is not due to water entering the lungs, but solely to the absence of air. If air be allowed to enter the lungs at the same time as the water, the animal suffers little or no inconvenience from the presence of the latter in the pulmonary tissue. One can wash out the lungs by a continuous stream of water, and the animal yet live. It may even be all the better for this species of pulmonary irrigation. It is only during the first few minutes that water induces much irritation, and causes the animal to struggle and cough. The irritation soon subsides; and if the water is allowed steadily and slowly to flow into the lungs

* As it will frequently be necessary, in the course of this article, to refer to the results obtained by the Committee, it may perhaps be as well to mention that the gentlemen composing it were—C. J. B. Williams, W. L. Kirkes, George Harley, T. I. Sanderson, C. E. Brown Séquard, H. Hyde Salter, W. S. Savory, E. H. Sieveking, Hon. Sec. Med.-Chir. Soc. (ex-officio). The report appeared in the forty-fifth volume of the Society's *Transactions*, 1862.

† Vide report, *Med.-Chir. Trans.* vol. xlv. p. 455.

no apparent inconvenience arises. Even half an ounce may be suddenly thrown into them, and, after causing the animal to make one or two deep inspirations, entirely disappear. This may be repeated at intervals of a few seconds for at least half an hour, without in the slightest degree endangering life. All that is required to insure success in this experiment is simply to allow of the admission of a sufficient quantity of air to keep up the arterialisation of the blood.

We have inserted and firmly tied into the trachea of a large dog a long glass-tube, to the upper end of which a glass-funnel was attached, in order to enable the experimenter the more easily to pour in water; and while the animal was lying on its back, ounce after ounce of water has been thus introduced into the lungs, and from thence absorbed into its circulation, without producing any visible disturbance, except during the few seconds that the water in its transit blocked up the tube and prevented the entrance of air.

If water be, as has been already said, slowly poured into the lungs, and sufficient air at the same time admitted, thirty, forty, or fifty ounces may be easily introduced in as many minutes; and on killing the animal an hour or two afterwards, not a trace of the liquid be found in the pulmonary tissue; the lungs at the same time appearing none the worse for the experiment.

There cannot be any longer much question about water entering the lungs in cases of drowning; and its absence in post-mortem examination is due, in all probability, to its subsequent absorption. In cases of persons drowned in ponds, duck-weed and other matters floating on the water have frequently been found in the trachea and bronchi, and yet no liquid detected in the pulmonary tissue. We have observed that in an animal that has struggled much, and frequently got its nose to the surface for a sufficient length of time to inhale a little air, there is far less water found in the lungs than in one that has been from the first wholly submerged. This is precisely what happens with human beings, who, even in cases of suicide, generally struggle for some time, and thus succeed in obtaining occasional gasps of air, at last succumbing to the combined effects of exhaustion and suffocation. Again, it may happen that on removal from the water the body may be so placed as to admit of the exit of any fluid that might chance to be present in the trachea and lungs. These are points which will be more easily understood after having discussed the pathology of drowning, so that it will be better in the mean while to turn attention to the consideration of the

Physiology and pathology of apnoea. In order to be philosophical as well as practical in the exposition of the physiology and pathology of this mode of death, it will be necessary to divide the various forms of death by apnoea into the four following classes, the subdivisions of which, for the sake of brevity, are best put in the shape of a skeleton diagram: Apnoea, 1st, from a mechanical impediment to the entrance of air into the lungs; 2d, from drowning; 3d, from the absence of oxygen in the respired gas; and lastly, from the inhalation of a toxic vapour associated with an absence of oxygen.

Apnœa may arise from

1st, Mechanical impediment to the entrance of air into the lungs.	Accident.	External.	Pressure on the trunk preventing the expansion of the chest; throttling; garrotting; strangulation by a cord; hanging; smothering by covering the mouth and nostrils, imbedding the face in earth, feathers, wool, &c.; paralysis of the respiratory muscles from injury to the spinal cord, or to the base of the brain; double penetrating wound of the chest admitting air.
		Internal.	Choking from a morsel of food or other substance blocking up the fauces; plugging of the trachea by a cherry-stone or other substance; constriction of the fauces and injury to the glottis from application of corrosive and irritating fluids.
	Disease.	External.	Pressure on the trachea from an aneurism or other tumour.
		Internal.	Œdema of the glottis; tumour on or about the vocal cords; false membrane blocking up the air-passages, as in diphtheria and croup; bursting of an abscess or aneurism into the trachea; double pneumonia or pleurisy; accumulation of mucus in the bronchial tubes; apoplexy at the base of the brain or in the medulla oblongata, causing paralysis of the pneumogastric and of the respiratory muscles.
2d, Drowning.			In any liquid of whatever nature,—water, wine, beer, or brine.
3d, Absence of oxygen in the respired gases.			Inhalation of pure nitrogen, hydrogen, or any other innocuous gas.
			Carbonic acid, carbonic oxide, coal-gas, choke-damp, ammonia, chlorine, sulphuretted hydrogen, arseniuretted hydrogen, antimonuretted hydrogen, sulphurous acid, nitrous acid, hydrocyanic acid, vapour of chloroform, ether, amylenes, or any other volatile product.
4th, Inhalation of a toxic gas or vapour.	In which death is erroneously attributed to apnœa.		

Death from a mechanical impediment to the entrance of air into the lungs.
 In many of the examples of death by apnœa cited in the above table, it is evident that it must occasionally happen that the death is accelerated by the direct action upon the body of the cause producing the apnœa. Thus, even in the first sub-class, which is specified as being due to mechanical obstruction to the entrance of air into the lungs, it can readily be imagined that the patient does not always succumb from pure apnœa. Fracture of the ribs, rupture of the liver, and many other injuries, may arise from pressure on the trunk, and thereby tend greatly to accelerate death. But there can be no doubt that in the majority of cases of suffocation arising from pressure on the thorax and abdomen preventing the expansion of the chest and consequent inhalation of air, apnœa is the immediate cause of death. For example it would have been so in the case of the black athlete, who nearly lost his life in consequence of the shrinking of the plaster-of-Paris in which he was

enveloped while having a cast of his body taken. The plaster shrank as soon as it began to set, and compressed the chest to such an extent that the poor man could neither breathe nor speak, and the extreme danger of his situation was only discovered just in time to rescue him from impending suffocation. In this case death would have been the result of pure apnœa.

Persons crushed in a crowd may die, in the same way, of pure apnœa, and even those accidentally buried beneath a fall of earth or stones, as well as such as are strangled with a cord, garrotted with the arm, or throttled with the hand; but in no one of these cases is pure apnœa of necessity the only cause of death. As a striking illustration, let us take death by hanging. It is known that, as a rule, the person is suffocated by the pressure of the rope on the trachea preventing the admission of air into the lungs. Occasionally it happens, however, especially in hanging at legal executions, where the body is allowed to fall from a distance with a sudden jerk, that the death is instantaneous, in consequence of dislocation or fracture of the vertebræ with an accompanying lesion of the spinal cord. The contrary may likewise occur, and instead of death being more rapid, it may in reality be slower than in pure apnœa. This may arise from the position of the rope on the neck being such as to interfere with the circulation in the jugular veins, and thereby induce an artificial apoplexy, which, by reducing the necessity for oxygen, allows the life of the individual to be prolonged beyond the limit allotted to pure apnœa. This statement will be readily appreciated after the effects of anæsthesia in cases of drowning have been explained.

It is hence evident that if we wish to study the phenomena presented in cases of death by pure apnœa, arising from a mechanical impediment to the entrance of air into the lungs, and to recognise the order of their sequence, it will be necessary to turn our attention for a few minutes to its least complicated form; and this unfortunately can only be satisfactorily illustrated by reference to experiments on animals. We must therefore leave aside for a time the consideration of its effects upon the human being.

The Committee of the Royal Medical and Chirurgical Society has furnished the following important data:

First, the duration of the respiratory movements.

Secondly, the duration of the heart's action.

Thirdly, the duration of the heart's action in relation to the duration of the respiratory movements.

The method of experimenting was as follows: The animal was secured on its back, and the trachea exposed by a single incision in the mesial line of the neck. A ligature having been passed round the windpipe, it was opened by a vertical cut, and a glass tube, as large as could be conveniently inserted, was passed into it for a short distance downwards, and firmly secured by the ligature. Through this tube, while patent, the animal breathed freely, but the supply of air could be at once completely cut off by inserting a tightly-fitting cork into the upper end of the tube. It was ascertained by separate experiments that the tube thus plugged with the cork in this manner it was found, from the results of nine experiments performed in this manner it was found,

First, that in the dog the average duration of the respiratory movements after the animal has been deprived of air is four minutes five seconds; the extremes being three minutes thirty seconds, and four minutes forty seconds.

Secondly, the average duration of the heart's action is seven minutes eleven seconds; the extremes being six minutes forty seconds, and seven minutes forty-five seconds.

Thirdly, the results of the experiments led to the belief that, on an average, the heart's action continues for three minutes fifteen seconds after the animal has ceased to make respiratory efforts; the extremes being two and four minutes respectively.

In the case of three domestic rabbits experimented upon, it was found that on an average they ceased to make respiratory efforts in three minutes twenty-five seconds; that their heart's action stopped in seven minutes ten

seconds; and consequently that the interval between the last respiratory effort and the cessation of the heart's action was three minutes forty-five seconds.

It will be here observed that there is no very marked difference either between the duration of the respiratory movements or of the heart's action in the powerfully-constituted dog and the weakly-constituted domestic rabbit. It appears, therefore, that in the absence of any positive reliable data regarding the absolute duration of the respiratory movements and of the heart's action in man in cases of death by uncomplicated apnœa, one may venture to assume that they do not differ very materially from those of the animals just cited.

The next point of importance to ascertain is the latest period at which recovery is possible after the simple deprivation of air. Here again the Committee has furnished important data, which may be usefully turned to account in considering the subject of treatment in the case of the human being.

The result of the experiments led to the conclusion—1st, that a dog may be deprived of air during a period of three minutes fifty seconds, and afterwards recover without the application of artificial means; and 2dly, that a dog is not likely to recover if left to itself after having been deprived of air during a period of four minutes ten seconds. Other experiments tended also to confirm the above fact, viz. that in dogs the doubtful interval of recovery and death lies between three minutes fifty seconds, and four minutes ten seconds.

From the results obtained by the Committee while engaged in ascertaining the exact period after the simple deprivation of air at which recovery is possible under natural circumstances without the aid of any artificial means of resuscitation, it was found possible to deduce the following conclusions, which most probably are as applicable to man as to the animals experimented upon by the Committee:

1st. That a state of apnœa being maintained for a given time, the later the respiratory efforts are continued, *i.e.* the shorter the interval between the last respiratory effort and the admission of air, the greater the chance of recovery.

2d. That air being admitted at a given time after the last respiratory effort, the earlier the respiratory efforts cease the greater the chance of recovery; for the earlier they cease, the shorter the interval between the establishment of, and the release from, the state of apnœa.

3d. In respect to the relation between recovery and the duration of the heart's action, it was found that under no circumstances did recovery ever occur when the heart's action, as indicated by a needle* inserted into the organ, had stopped.

Apnœa from submersion. We have now to consider the second form of death by apnœa, viz. that by drowning. As will be immediately seen, it presents conditions differing widely from those met with in any of the forms of death just considered, arising from the mechanical obstruction to the entrance of air into the lungs.

First, as regards the length of time a person may be submerged and yet recover.

Before discussing this point in connexion with the human being, it will be advisable, in order to place the subject in its clearest light, first to examine the results which have been obtained from experiments on animals, as they explain many of the phenomena occurring in man, which have hitherto been regarded as obscure.

* The duration of the heart's action was conveniently ascertained by means of a long pin inserted through the thoracic walls into some part of the ventricles. So long as the heart continued to beat, the pin moved, and its motions were thus recorded for some time after the cardiac sounds had ceased to be audible. The needle may be withdrawn and reinserted several times without producing any other result than slight temporary acceleration of the heart's action.

Having seen what the effects of simple apnoea are, we shall now proceed to quote the results of the experiments performed by the Committee, which illustrate the effects of drowning.

1st. When a dog was kept under water only one minute, it recovered.

2d. When a dog was submerged one minute fifteen seconds, it also recovered.

3d. When a dog, treated precisely in the same manner, was submerged one minute thirty seconds, it died; and this was invariably the case, even when the animal was not only able to make spontaneous efforts at respiration, but actually capable of giving a cry after its removal from the water.

Thus, then, we are here furnished with the remarkable fact, that whereas in simple apnoea recovery is always possible after three minutes fifty seconds, only one and a half minutes' complete submersion in water suffices to destroy life. To what is this extraordinary difference due?

In order to solve this question the Committee placed two dogs under precisely similar circumstances, with the exception that in the one case the free access of water to the lungs was permitted, and in the other prevented. The following were the experiments:

First. Two dogs of the same size were fastened to the same plank and submerged at the same moment, one of them having previously had its wind-pipe plugged in the usual way, and the other not. At the end of two minutes they were simultaneously removed from the water. The one that had the trachea plugged at once recovered; the other died.

Secondly. The above experiment was repeated, the dogs being kept under water four minutes. When removed from the water, the dog that had his trachea plugged got up in a few minutes comparatively well; while the other, though gasping when taken out, died.

These experiments satisfactorily show that the difference between apnoea produced by plugging and that by drowning is not due to submersion, to depression of temperature, or to struggles, seeing that the two animals were placed under precisely similar conditions, with this most important exception, that in the one case a free passage of air out of the lungs, and of water into them, was permitted; in the other, the exit of air and the entrance of water were alike prevented.

There can be no doubt that both these circumstances are concerned in producing the difference in the results of the two experiments. Moreover, the condition of the lungs, as revealed by post-mortem examination, appeared to the Committee to furnish a further proof that the shortness of the period of immersion, which proves necessarily fatal to an animal, is mainly due to the entrance of water, and the effects thereby produced.

On examining the lungs of the animals deprived of air by plugging the trachea, they were found simply congested; but in the animals drowned, not only was the congestion more intense, accompanied with ecchymosed points on the surface and in the substance of the lung, but the air-tubes were completely choked up with a sanious foam, consisting of blood, water, and mucus, churned up with the air in the lungs by the respiratory efforts of the animal. The lung-substance too was heavy, and saturated with water.

Since the conclusion of the labours of the Committee, we have carried the inquiry a step further, and ascertained that the effects of the water extend beyond the mere pulmonary tissue. In some carefully performed experiments, we found that in cases of drowning the blood in the left side of the heart contains much more water than that on the right; and when examined microscopically, the blood-corpuscles from the two sides of the heart present entirely different appearances. Thus, for example, we ascertained that while in the blood of the right auricle or ventricle the corpuscles may be nearly all serrated; in the watery blood from the left side of the organ it is not only frequently utterly impossible to detect a single serrated corpuscle, but in the latter blood, many of the cells have swollen up, burst, and allowed their colouring matter to escape, and stain the serum of a deep red colour. In

some cases we also noticed that occasionally, when there was scarcely a whole blood-corpuscle to be seen, the field of the microscope was occupied by an immense number of small bodies like escaped nuclei, and we are not yet quite certain that they were not nuclei, notwithstanding it was dog's blood we were examining, which is supposed to possess only non-nucleated blood-corpuscles. Although this peculiar effect of the water on the blood-corpuscles may have something to do, as we shall presently see, with secondary apnœa, we do not consider that it influences, to any marked degree, the rapid extinction of life in cases of complete submersion. The death in such cases is much too speedy to be thus accounted for. We shall shortly see that the difference in the time required to drown and to suffocate an animal must be due to an entirely different element, namely, the presence or absence of air in the lungs. That a moderate amount of air suffices to sustain life for some length of time is well illustrated, as regards the human being, in the case of sponge- and pearl-divers, who, through the influence of habit, are able to bear submersion for a period which would be exceedingly perilous to the non-habituated. Lefevre states that he has seen Navarino sponge-divers remain under water for nearly two minutes, their average time of submersion being about eighty seconds. Mr. Reynaldo, late Port-Surgeon at Bombay, informs us that he has frequently timed the most expert divers in the Bombay harbour, and that some of them could sustain entire submersion for two and a half minutes. In order to accomplish this, however, they are forced to employ an artificial aid to the retention of the air in the chest. Immediately before diving, they forcibly distend the lungs with air, and instantly afterwards slip over the nose a clip made of bullock's horn, in order to prevent any involuntary expirations. The lips, being much more easily controlled than the nostrils, are left unprotected.

For the reasons given at pp. 876, 877, when treating in general terms of the effects of the introduction of water into the lungs, it cannot be said that the greater rapidity of death in submersion over simple apnœa depends on the deleterious action of the inspired water; and, as has just been shown, it is equally impossible to attribute it either to the struggling of the animal or to the external influence of the water on the frame. One is thus compelled to seek for another explanation of the phenomenon. It appears to our mind that the true explanation lies in the facts just alluded to, namely, that when the lungs are full of air, the escape of which is prevented, the animal obtains sufficient oxygen to support life for at least double the time if would do if they were entirely empty. Thus, for example, when the trachea of the animal is plugged, as in the experiments of the Committee, not only is the entrance of water prevented, but the exit of air is stopped. So also in the case of the pearl-divers: the clip on the nostrils acts the part of the plug in the trachea, and, by putting a restraint on involuntary respiration, enables the individual to retain in the lungs a quantity of air from which the blood can extract sufficient oxygen to prolong life within certain limits.

Dr. Sanderson, moreover, informs us that he has been able to demonstrate this fact by direct experiment, and that he finds that in animals the duration of life, up to a certain point, is in an exact ratio to the quantity of air confined in the chest.

When an animal is entirely submerged and fills its lungs with water, all, or nearly all, the air contained in the pulmonary vesicles at the moment of its submersion is expelled, and it is thereby placed in the most unfavourable circumstances for the prolongation of its life. The same thing occurs when an animal is confined in a jar of pure nitrogen gas. The air in the lungs is rapidly replaced by a gas incapable of supporting life, and the animal speedily perishes—much sooner than if the lungs were filled with air and the trachea plugged. These facts, as we shall presently find, are of the utmost value in connexion with the subject of treatment; for, as will be seen, paradoxical as it may appear, the best way to preserve life, under certain circumstances, is to stop breathing.

In entering a place full of foul air, for the purpose of rescuing some one who has become insensible, a deep inspiration should be taken, and then the breath held the whole time the person is in the poisonous atmosphere; just in the same way, and for similar reasons, as a man fills his chest with air before diving, and holds his breath the whole time he is under water. It might be said that these views are still further supported by the facts discovered by the Committee of the Royal Medical and Chirurgical Society, namely, that while a dog submerged for a minute and a half, without being previously chloroformed, dies, a dog, previously rendered insensible by chloroform, may be submerged for two minutes fifteen seconds, and yet recover. It is thus seen that by simply depriving the animal of the power of making voluntary respiratory efforts, the period during which submersion may be continued, and yet recovery follow, is at once prolonged.

Effects of syncope in favouring recovery in cases of drowning. The occurrence of syncope is said greatly to augment the chances of recovery in cases of submersion. And it does so, no doubt, within certain limits, for the same reason as anæsthesia does, namely, by reducing the number of respirations. It has, however, a still further advantage in temporarily arresting tissue-metamorphosis, and thereby reducing the necessity for oxygen. We cannot, however, believe that syncope is capable of prolonging life beyond a very few minutes, for the simple reason that the heart's action cannot be arrested for even a very brief space of time without inducing a fatal result. In a drowned animal, although the movements of respiration stop much sooner, half as soon again as in a strangled one, the heart's action continues for nearly the same length of time, namely, from seven to nine minutes; and in neither case is it possible to resuscitate the animal after the entire cessation of the heart's action.

It appears to us that the majority of persons have most erroneous notions regarding the duration of syncope in general, and syncope under water in particular. Many cases, where the patient is not submerged, are mistaken for syncope, which are not in reality such; both the respiration and the heart's action continuing, but so feebly as, in a cursory examination, to escape detection. We doubt very much, judging from what we know of the phenomena of the cardiac action (for, be it remembered, there is no direct evidence one way or another), if it is probable, or even possible, for the heart to resume its action after five minutes' entire cessation. This leads to the question, *How long may a human being be under water, and yet recover?* This entirely depends on the degree of the submersion. If a person be completely submerged, and the entrance of water to, and exit of air from, the lungs not prevented, we believe that recovery would be impossible after two minutes. On the other hand, if the air-passages were closed against the entrance of water, and the chest kept full of air, we see no reason for thinking that a human being would perish either more slowly, or more quickly, than a dog placed under similar circumstances, namely, in from four to five minutes.

The reason why some persons remain a long time in the water, and yet ultimately recover, is that they are never, or at least only for a very short part of the time, totally deprived of air. Every now and then their heads come to the surface, and they obtain an inspiration. Even if they can but gasp in a small quantity of air, and that too accompanied with water, they may be able to struggle on for a long time, as it is only the total deprivation of air that kills quickly. A person can exist for an hour on a very small quantity of air, if it be but frequently enough exchanged. This fact we see illustrated every day in the persons of patients suffering from pneumonia supervening on phthisis, who struggle on for hours with only a portion of their lungs capable of performing the functions of respiration. Then, again, as regards the damage done to the pulmonary tissue by the entrance of water, that, we have already seen, can at most be but very trifling, for the liquid is rapidly absorbed into the circulation from the pulmonary vesicle, and leaves scarcely a trace of its transit (see p. 877).

The effect of water upon the blood itself is much more marked; for as

was said at page 881, it thins the vital fluid, and when in large quantity even destroys a number of the blood-corpuscles. When we consider, however, the very large amount of blood in an adult body, at least fifteen pounds, and the proportionally small amount of water taken in at a time, we can readily understand how it is that its effects are rendered apparent only in cases of complete submersion. In the case of dogs whose lungs have been irrigated with water, it is difficult to detect any deleterious action of the water upon the blood-corpuscles; and this probably arises from its rapid elimination preventing any visible injurious dilution of the vital fluid. Such an action it must, however, to some degree exert.

The effect of temperature on the rapidity of death in cases of drowning. The temperature of the water influences to some extent the rapidity of the fatal result. If we take the normal temperature of the animal as the starting-point, we find that death is more rapid as we descend towards the freezing, and ascend towards the boiling, point. The temperature of the human body being, in round numbers, 100° F.,—if a person be submerged in water at the freezing-point, *ceteris paribus*, the quicker is the death. This conclusion we have arrived at from the results of experiments on animals, as well as from what we witnessed in the human being a few years ago, when fourteen persons were nearly drowned by the sudden breaking-up of the ice on the water in the Regent's Park. The explanation appears simple enough, when we remember that intense cold paralyses the muscular energies of the individual, and thereby prevents his continuing the efforts requisite to enable him to get occasional inspirations; consequently the person becomes totally submerged more quickly than he would otherwise be.

Heated water, on the other hand, seems to favour death by hastening the action of the already weakened heart, as well as by accelerating tissue-metamorphosis, and thereby increasing the demand for oxygen.

It is only when water is considerably below or above 100° F. that the effects of temperature become visible; a degree or two one way or the other gives rise to no apparent effect.

Apnœa the result of an absence of oxygen in the respired medium. The simplest form of death arising from apnœa, or the non-arterialisation of the blood, is when there is no obstruction to the entrance of air into the lungs, but merely an absence of oxygen in the inspired gas. This is well illustrated, for example, when an animal is placed in a jar of nitrogen. It dies, and that too in a very few minutes; not from the introduction of a poisonous material into the system, but solely on account of the absence of oxygen in the inspired medium.

Nitrogen is perfectly harmless to animal life. We are constantly breathing it, and suffer no disagreeable effects from it. On the contrary, it is a necessary diluent of the oxygen of the air. The atmosphere normally contains no less than 79 per cent of it. Nitrogen itself is, however, neither a supporter of combustion nor of life; hence it is that animals cannot live in it. Moreover, they die quicker in perfectly pure nitrogen than when strangled, for the reason previously given, namely, that the inhaled nitrogen displaces a certain amount of the oxygen from the air-vesicles, and thereby reduces the animal to the condition of one whose air-vesicles have been emptied of oxygen by water. The influence of nitrogen extends even somewhat further. For, according to Graham's law of the diffusion, and Henry and Dalton's law of the absorption, of gases, the inspired nitrogen not only displaces the free oxygen present in the pulmonary air-vesicles, but withdraws the absorbed oxygen from the blood itself. This is probably the true explanation of the fact that animals die more rapidly when placed in perfectly pure nitrogen gas than when suffocated in any other way. Hydrogen acts in a nearly similar manner; but its effects on the animal body have not been sufficiently studied to admit of our drawing any general conclusions from them. Some have even hinted that hydrogen gas has special toxic properties; and if so, it ought properly speaking to come under the next head.

Apnoea from the inhalation of toxic gases and vapours. There are very few gases that cause death by true apnoea. Most, indeed all, with the exception of nitrogen and hydrogen, and possibly even the latter, as has just been said, kill by means of their toxic properties. Although, therefore, we have been compelled on this occasion to sacrifice scientific accuracy to common custom, and include under the headings of death by apnoea that arising from the introduction into the system of noxious gases and vapours from volatile liquids, we shall merely point out how their action is totally distinct from that of pure apnoea, and then pass on to another department of our subject.

In the case of the inhalation of each of the gases included under this head (see table at p. 878), carbonic acid, carbonic oxide, charcoal vapour, coal-gas, sulphuretted hydrogen, arseniuretted hydrogen, chlorine, sulphuric ether, chloroform vapour, &c., there may be, no doubt, an absence of oxygen in the respired medium; but in no one of these cases can this be regarded as the sole cause of the fatal result. Quite the contrary; it appears rather that the destruction of animal life in the majority, if not in all of these cases, depends much more upon the entrance of the toxic agent into the circulation than upon the mere deprivation of oxygen. Consequently the symptoms manifested in cases of poisoning by these gases differ according to their chemical nature, and the intensity of their poisonous properties. Let us take arseniuretted hydrogen, for instance; if this gas be so given as to exclude the simultaneous introduction of oxygen, the animal dies not only much quicker than it does when its windpipe is tied, but also quicker than when it is suffocated in pure nitrogen gas; the cause of the difference in the rapidity of action being simply due to the toxic effects of the gas upon the nervous system. With chloroform the fact is equally well exemplified. Death from chloroform is commonly placed among the deaths from suffocation. Now the results of the experiments of the chloroform Committee of the Medical and Chirurgical Society (1864) have shown that a chloroform death is not one by apnoea at all, but is unmistakably one by pure asthenia. When the undiluted vapour of chloroform is introduced into the lungs, animal life is rapidly destroyed, much more rapidly indeed than under even the very quickest form of death by apnoea. Thus, while a drowned dog makes attempts at respiration during at least two minutes, and its heart's action continues to be perceptible for seven minutes, a dog poisoned with undiluted chloroform vapour inevitably dies in fifteen seconds; both respiration and cardiac pulsation being totally annihilated in that brief space of time. These are fortunately not the usual effects of chloroform; for since it is generally given in a diluted state, the oxygen of the atmospheric air with which it is accompanied suffices to arterialise the blood sufficiently for the maintenance of organic life. But even death arising from diluted chloroform vapour is in no case due to apnoea, but to the poisonous nature of the substance itself. This is proved by the cessation of the heart's action occurring almost as soon as efforts at respiration cease, as well as by the blood on the right side of the heart being darker than that on the left, neither of which is ever the case in apnoea; the heart in apnoea always continuing to beat two or three minutes after the respiration has stopped, and the colour of the blood on both sides being invariably identical.

Even carbonic acid circulating in the capillaries acts as a direct poison on the tissues. This we have seen well illustrated while studying the duration of the cardiac pulsations after different modes of death. Thus, the heart of a cat that has been suddenly deprived of life by section of the spinal cord at the vital point, will continue to pulsate, under favourable circumstances, for forty minutes after the animal's death: whereas the heart of a cat allowed to die slowly by strangulation, under the same circumstances, generally stops in less than twenty minutes after the death of the animal.

Enough, we think, has been said to show that these gases and vapours are in reality active poisons; and perhaps also sufficient to convince our readers

that, notwithstanding the extreme interest of the subject, it would be injudicious for us to give to it more prominence in an essay on apnœa. Before leaving the subject, however, we would beg to make one further remark, namely, that the post-mortem appearances in cases of poisoning by the substances included under this head vary as much as the symptoms themselves. In some they are even totally opposed. Thus, for example, while the muscular tissues and organs of an animal poisoned with sulphuretted hydrogen are of an intensely dirty-black colour, those of an animal that has succumbed to the effects of pure carbonic oxide are of the most beautiful vermilion hue. So it can be readily imagined that, even if we felt inclined, it would be impossible for us, in the short space at our disposal, to give an outline of the symptoms and post-mortem appearances produced by all the substances that might be included under this heading.

Theory of the cause of death in apnœa. Various authors, in explaining, or in attempting to explain, the reason of the cessation of the vital functions in cases of death by apnœa, have given very different views on the subject. One ascribes the death to a mechanical stagnation of the blood in the lungs (Haller's original doctrine). Another thinks it due to the non-stimulating venous blood failing to excite the heart's action (Goodwyn). A third to the poisonous effects of venous blood upon the tissues (Bichat). A fourth to the gradual failing of the blood to penetrate the pulmonary tissue (Alison). While, lastly, the doctrine which has now received almost universal assent is that first propounded by Kay, namely, that the cause of death in apnœa is due to the circumstance of the capillaries of the lungs, which usually convey arterial, being incapable of conveying venous blood; and consequently that the blood, as Haller said, stagnates in the lungs. Moreover, that the functions of the muscular organs, the heart included, gradually cease on account of this arrest of the pulmonary circulation, and not, as Bichat imagined, because of venous blood possessing any noxious quality.

It is thus seen that, in Kay's doctrine, although it is doubtless admitted that in death by apnœa the heart's action is weakened in consequence of the imperfect stimulus afforded to it by the venous blood penetrating its substance, the main cause of the failure of the circulation is supposed to be the difficulty which the non-arterialised blood finds in passing through the capillaries of the lungs.* This theory was thought consistent with all the phenomena observed in cases of death from apnœa. It will be found, however, from what has preceded, that in the explanation of apnœa as now understood, this theory is open to certain grave objections. Indeed, the same observation is applicable to all the theories that have as yet been advanced: for the particular reason, that they one and all, with the exception of Goodwyn's, have for their foundation that part of the original doctrine of Haller which attributes the failure of the heart's power and loss of nerve-function to the arrest of the pulmonary capillary circulation.

The results of Goodwyn's experiments, had they been properly considered, might have led to a different conclusion from the above; for in them it is clearly shown that, for a time at least, the non-arterialised blood passes through the lungs, and enters the left auricle and ventricle of the heart. Moreover, in apnœa it is the right side of the organ that first ceases to pulsate. Bichat appears to have had a clearer idea of the sequence of death in apnœa than any previous or subsequent writer, and may be said to have only failed in arriving at the truth from having held to the idea that venous blood poisons the tissues with which it is brought in contact.

In attempting to explain the cause of death by apnœa, it is necessary to go a step or two further than has hitherto been done; and, instead of merely limiting the question to an explanation of the most prominent of the effects

* Vide Watson's *Lectures on the Practice of Medicine*, 3d ed. vol. i. p. 69.

of this mode of death, to attempt to follow up the subject until we arrive at the preeminent cause of the arrest of the various functions. In order to do this, it is necessary to begin *ab initio*.

As is well known, the continual afflux of arterialised blood to the various animal tissues is a condition not only important but imperative to the continuance of life. All the molecular transformations of organised matter, of which "life" is but the manifestation, are so utterly dependent on the continued supply of scarlet blood, that no sooner is it cut off than they instantly cease. Without oxygen there can be no life. Not a single new cell can be formed, not a single old one can be destroyed, without the influence of this all-important agent. From the first moment the animal germ springs into existence, during its development into tissues, and throughout its whole life as an organised body, up to the time of its death, arterialised blood is being uninterruptedly employed; and in exact proportion to its supply, *ceteris paribus*, are the many and intricate organic functions accelerated or retarded. Nervous action, muscular contraction, secretion, and excretion, are all equally under its sway; so that it is impossible to feel in the least degree astonished that in apnoea, which essentially consists in the arrest of the oxygenisation of the blood, all the functions of life should be rapidly brought to a standstill.

Apnoea may with perfect justice be defined as death from arrested interstitial nutrition.

Were it considered necessary to prove the basis on which this doctrine rests, there would be no difficulty in so doing; for all that is required is simply to draw a parallel between the effects of a deficient supply and an impaired quality of nutritive material on the various functions of the body, when it will be immediately seen that their effects are in reality identical. For example, we have a striking illustration of the effects produced on the body by a sudden deficiency in the supply of blood presented to us in cases of death by hæmorrhage. In these cases there is of course an actual absence of the nutritive materials; and, as will presently appear, that absence gives rise to precisely the same chain of symptoms as is met with in pure apnoea; which, on the other hand, is an apt illustration of the effects of an impaired quality of the material.

Thus, in death by hæmorrhage, there are the confusion of ideas, the unconsciousness, the convulsions, the stupor, the paralysis of the muscles, the stoppage of respiration, and lastly the cessation of the heart's action; all following upon each other in precisely the same order of sequence, and with the same ultimate result, as in those cases where there is no absence of the materials themselves, but only of that substance which fits them for the performance of their peculiar office—oxygen.

The same thing even occurs, when not only the materials but also the oxygen itself is present, if the two are prevented from combining, and thereby becoming fitted for the purposes of nutrition. This occurs, for example, when there is present in the circulation a foreign material which possesses the property of preventing the constituents of the blood from entering into combination with oxygen. In such a case, precisely the same symptoms may be induced as we have seen follow either the entire absence of both nutritive materials and of oxygen, as in hæmorrhage; or only an absence of oxygen, as in apnoea. Alcohol might be cited as an example of a substance possessing the power above alluded to; and the symptoms it gives rise to, when taken in a poisonous dose, closely resemble in many respects the effects of slowly-induced apnoea. The peculiar effect which alcohol exerts in preventing the oxidation of the constituents of the blood has been illustrated by us in the following manner:

A certain amount of cow's blood was confined with an equal quantity of pure atmospheric air, and kept at a moderate temperature during twenty-four hours. At the expiration of that period the air was found to have undergone a change; it had lost oxygen and gained carbonic acid.

For, while the pure atmospheric air brought in contact with the blood consisted of

Oxygen	20·960	} total 20·962
Carbonic acid . .	0·002	
Nitrogen	79·038	
100·000		

that removed from the retort after its twenty-four hours' contact with the blood consisted of

Oxygen	10·58	} total 14·91
Carbonic acid . .	3·33	
Nitrogen	86·09	
100·00		

thereby showing that oxygen had been absorbed, and carbonic acid exhaled. To a precisely similar quantity of blood from the same animal was added 5 per cent of alcohol. The blood was then placed in contact with an equal amount of pure atmospheric air, and kept twenty-four hours at the same temperature and under precisely the same circumstances as the others; notwithstanding which the air on analysis was not found to have become nearly so much changed as in the second case when it was in contact with pure blood. On the contrary, the air was found on analysis to consist of

Oxygen	16·59	} total 18·97
Carbonic acid . .	2·38	
Nitrogen	81·03	
100·000		

thereby proving that alcohol possesses to some extent the power of arresting the arterialisation of the blood, and thereby its becoming fitted for the purposes of nutrition.

The effects of alcohol and many other substances on the nervous system are, in a great measure, due to their action on the blood; and if the above explanation be the correct one, there can be no difficulty in understanding why, in certain cases of poisoning, the symptoms so frequently resemble in some respects those met with in pure apnœa.

As a further illustration of the intimate connexion between functional activity and oxidation, we might call attention to what is observed to occur during muscular contraction.

It is a well-known fact that the exposed muscles of the frog absorb oxygen and exhale carbonic acid in definite proportion, so long as muscular irritability continues; and that as soon as the irritability of the muscles ceases, an important difference occurs in the amount of the gases interchanged. Moreover, we have found that any thing that interrupts the interchange of the gases tends to arrest the muscular action. This is best seen in connexion with the rhythmical action of the involuntary muscles of the heart, when it has been separated as far as possible from all nerve-influence. As is well known, the extirpated heart of a healthy frog will continue to pulsate regularly for an hour after its separation from the nerve-centres; we have, however, observed that if the heart be placed in contact with any of those substances that possess the power of preventing the arterialisation of the blood, its action is speedily arrested. In illustration of this we may cite the following experiment which we performed several years ago (*Lancet*, 14th June 1856).

When the hearts of two frogs are removed from the body, and one placed in pure distilled water, while the other is put into a solution of the acetate of strychnia (strychnia has the power alluded to, of preventing the absorption of oxygen and exhalation of carbonic acid by the blood), the former will pulsate regularly for more than an hour, the latter will cease to beat in from *one to five minutes*, according to the strength of the solution of the poison. And

what is still more remarkable, the contractile power of the heart is gone for ever. Mechanical, chemical, or galvanic stimuli alike fail to reawaken it.

Since the foregoing was written, we have had occasion, in the capacity of member of the Medical and Chirurgical Society's Chloroform Committee, to study the effects of the direct action of the vapour of chloroform and ether upon the heart. For this purpose the following experiment was performed:—Three small glass jars were placed in a row, and each covered with tin-foil, from the centre of which descended a small hook, to which was attached by the aorta the heart of a healthy frog. All three were retained under precisely the same circumstances, with the exception that in the bottom of one jar were a few drops of chloroform, in another a similar quantity of ether, and in the third the same amount of distilled water. The result was, that while the heart that was suspended in aqueous vapour pulsed regularly for an hour or so, that in ether-vapour stopped in less than fifteen minutes, while the one in the atmosphere of chloroform ceased to pulsate within ten minutes. Facts which add still further strength to the foregoing opinion.

No one, we suppose, at present doubts the fact that the ultimate cause of death in apnœa, no matter in what manner it may be induced, is the absence of oxygen. We may add, that in our opinion this absence of oxygen acts indirectly, and that the extinction of animal life is in consequence of the constituents of the blood not having undergone the oxidation-process, which is essential to the proper performance of their functions when brought in contact with the various tissues and organs of the frame. The confusion of ideas, the unconsciousness, the convulsions, the stupor, the paralysis of the muscles, the stoppage of respiration, the arrest of the heart's action, appear to us to be one and all due to the same cause, *arrested interstitial nutrition*. It is thus seen, then, that what others have hitherto regarded as the primary cause of death in apnœa, namely, the stoppage of the circulation in the lungs, the failure of the heart's action, &c., we look upon as merely the secondary effects of the gradual extinction of life. No one would, of course, venture to assert that the above is of necessity the true explanation of death by apnœa; for all are well aware that as science advances, new facts may be discovered, which may either demand its modification or abandonment; but one thing we may venture to assert, namely, that this "arrested interstitial nutrition" theory is by far the least open to objection of any that has hitherto been propounded, and that it has the advantage not only of giving a rational explanation of the symptoms, and their order of sequence, but is also in perfect conformity with the appearances observed after death.

Secondary apnœa. We have now to call attention to the fact which has been so frequently observed, more particularly in cases of drowning, that an individual may apparently recover from the primary effects of apnœa, and after the lapse of some minutes, hours, or days, suddenly expire without any apparent cause. This secondary death occurs not only after drowning, but after each and all of the causes of apnœa given in our table. Indeed, it is not much less common after hanging than after drowning; and it has been equally observed after the administration of poisons, more especially of the volatile group denominated anæsthetics.

Lest some may imagine that the secondary form of death now under consideration is nothing more than death following upon imperfect resuscitation, we may at once inform them that it is entirely different. Take, for example, a case of drowning; and we may quote the following, which we heard of in consequence of the gentleman in whose practice it unfortunately occurred being unjustly accused of having treated the case improperly: The patient, a healthy young man, while bathing, accidentally got out of his depth, and before being rescued became much exhausted. On his removal from the water, he was quite unconscious, although the respiratory process still continued. The usual restoratives were applied, and the patient was soon able to speak. He was taken home, and, at the suggestion of the medical attendant,

who considered him out of all danger, had some opening-medicine given to him and was put to bed. In the middle of the night, about ten hours after his immersion, he was suddenly heard by a person who occupied the same apartment, to make a noise, as if in a convulsion. When a light was obtained, it was found that he had become quite livid in the face; and before medical aid could be procured, he expired. At the post-mortem examination nothing was detected to account for the sudden death.

This we regard as a death from secondary apnœa.

Sir B. Brodie, on the other hand, relates the case of a lad who was found hanging by the neck insensible, who died twenty-four hours after he was cut down; and at the post-mortem examination nothing abnormal was detected in the body except congestion of the cerebral vessels.

Linhart, again, relates a most interesting case of a perfectly healthy peasant who died eighteen and a half hours after having been rendered only partially insensible by an ounce and a half of chloroform given in the usual way over a period of thirty minutes. The patient continued perfectly well until the next morning at six o'clock, when he suddenly died. On examining the body twenty-four hours after death, all the organs were found healthy.

These cases, which have generally been classed under the head of death either arising from collapse or of spasm of the glottis, are certainly peculiar; but nevertheless we consider them as merely the secondary results of the arrested interstitial nutrition that took place during the period that the breathing was partially arrested.

If we may be allowed to use a homely expression in order to illustrate how the secondary apnœa may arise from a preceding mal-nutrition, we should say that it does so in the same way as a single layer of bad bricks put into a house while building may cause at a subsequent period its premature decay; the layer of bad tissue laid down during the temporary cessation of respiration induces the subsequent premature decay of animal life. This theory will be still better understood if we illustrate it by what is observed to occur to horses after temporary starvation.

Many years ago the French government appointed a commission to inquire into the effects of starvation on cavalry horses; and the results obtained were not only interesting, but most important. Among others, for example, it was found—

1st. That after ten days' total deprivation of food, a horse is still able to gallop, although not very long; and after being again well fed, makes a tolerably rapid recovery.

2d. That a horse may live for twenty days without nourishment of any kind, and still make a temporary recovery.

3d. That an animal starved for a certain time, although he makes a temporary recovery, never regains his pristine strength, no matter how well fed he may subsequently be.

Thus it was found, that though the horses that had been kept fasting during a period of ten days, and then well fed, apparently recovered rapidly from the effects of the starvation, yet they never were so strong as other horses, and that they succumbed to disease much more readily than others. This failure in the vital stamina, if it may be so termed, we believe was owing to the mal-nutrition that occurred during the previous term of starvation. The subsequent death of the horse might therefore be said to be the secondary result of starvation. The peculiar condition of the red blood-corpuscles, which was mentioned as occurring in cases of drowning, may in some degree aid in the understanding of what is here termed mal-nutrition, as applied to the secondary apnœa of drowning. It will be remembered that, while abundance of serrated blood-corpuscles was found in the blood of the right side of the heart, there was not only a total absence of them in the watery blood of the left, but that a great number of the normal blood-cells had disappeared; the field being occupied by small granular bodies, looking something like

nuclei, that might have escaped from the swollen and burst corpuscles. This observation was of course made upon a fatal, and consequently exaggerated, case; but it is very easy to imagine a less formidable one, in which, during the period of recovery from the effects of drowning, a layer of bad tissue might be deposited from the partially disorganised blood-corpuscles, which of necessity would diffuse themselves throughout the circulation along with those that had escaped the pernicious action of the water. We are here speaking of the visible effects of drowning upon the circulation; but how many and intricate are the changes which may have taken place in the blood, during the period of apnoea, that are entirely beyond the cognisance of our senses!

In order properly to comprehend the meaning and pathology of secondary apnoea, it is necessary to have a clear idea of the process of nutrition.

It is a common belief that, as we eat and sleep at stated periods, nutrition is not a constant but an intermittent function; an opinion from which we entirely dissent, as not being in conformity with the present state of physiological science. To our mind nutrition appears to be a constant process; fluctuating, it may be, but nevertheless continual. The secretion of milk, urine, bile, and semen goes on during every hour of the day and every minute of the night. It is only the expulsion of the accumulated products that is periodic. So again with food. Just as the camel can pass several days without drinking, if he has previously supplied his reservoir with water, so can man go several hours without eating, if he has previously laid into his stomach a stock of food. The animal, like every other machine, to do constant work must have a constant supply of material. Life, indeed, might not inappropriately be compared to a web of cloth made of the purest American cotton, and each stoppage in nutrition to a flaw. Thus each disease, each temporary illness, although not producing an actual gap, would weaken the web by introducing into it an inferior quality of cotton. It might only be a single thread, or it might be many threads; but still the web would be weakened by their presence. Do we not every day see around us evidence of the flaws in the human webs? Look, for example, at the teeth. Are the furrows we occasionally see across them not the tell-tales of the severe illness of youth? Are they other than the marks of arrested nutrition? So again with the nails: do they not, after a smart attack of scarlet-fever, indicate by their grooves the severity of the illness? Can the falling out of the hair after typhus be said to be due to any thing else than temporarily arrested nutrition? Even the mind itself does not escape the general ill. Bad tissue deposited produces bad memory. Old people remember distinctly all that occurred to them in their youth, when good tissue was being laid down; but forget the occurrences of the previous day, when in old age the material is of an impaired quality. So also it is found, and for a similar reason probably, that it occasionally happens that, after a severe illness, little is remembered of what occurred during it. Interstitial nutrition is constantly going on, and it cannot be for an instant interrupted without threatening to bring the machine to a stand-still. Moreover, we might go a step further, and say that the more quickly it does its work, the sooner will its labours cease. Waste and repair cannot go on indefinitely in the animal body any more than in the locomotive. Supply the engine with coals and water as carefully as you will, it will still wear out. That is, however, not the point with which we have at present to deal. It is the temporary arrest of the supply of material we are now considering; and as we have already said, during the period of apnoea it is that supply that is interfered with, and makes the flaw which, although not sufficiently great to produce at once a rent in the web (immediate death), sooner or later causes it to give way (secondary apnoea).

Treatment of apnoea. In considering the treatment of cases of impending death by apnoea, it will be advisable, in order to save time and space, first to lay down the general principles on which it is founded, and afterwards proceed to show in what manner these require to be modified in their application to special cases.

Having ascertained from the history and symptoms that the case is one of apnœa, and not of narcotic poisoning or apoplexy, which, as has been previously shown, under certain circumstances may be confounded with it, the first thing to attend to is the removal of all visible impediments to the natural performance of the respiratory process, and then as rapidly as possible to place the patient under the most favourable circumstances for the reception of a free supply of air. Having done so, time may be taken to inquire more minutely into the state of the patient, and thereby obtain some notion of the probable chances of recovery.

If the eyes are open, the pupils dilated, the conjunctiva insensible, the countenance placid, the skin cold, frothy mucus round the nostrils and mouth, no attempt at respiration, and the heart's action inaudible, the case is hopeless. N.B. As the pulse ceases to be perceptible at the wrist some time before the action of the heart entirely stops, the ear must in all cases be applied to the chest before definitely concluding that the case is hopeless.

If, on the other hand, there is the slightest evidence of respiratory effort, of heart's action, of twitching of any of the muscles, and especially if the apnœa is known to have been of short duration, there is every hope of recovery; and in direct proportion as either or all of the above signs are marked, are the chances of recovery increased. As the primary object in all cases of apnœa is to arterialise the blood as rapidly as possible, various methods for the accomplishment of this object have at different times been proposed. Numerous forms of apparatus have also been invented, in order the more readily to perform artificial respiration, several of which we have tried (Erichsen's, Sibson's, Marcet's, &c.); but we cannot venture to recommend their employment. First, they are not always at hand; secondly, there is no time to send for them, even although they could be procurable in the short space of two minutes; thirdly, they are troublesome in the application; and fourthly, after a pretty large experience with them on animals, we may venture to affirm that they are at last not more effectual than the apparatusless modes we are now about to describe.

1st. Artificial respiration by simultaneous pressure on the abdomen and thorax.

2d. The Marshall-Hall method.

3d. The Silvester method.

Artificial respiration by simple pressure on the abdomen and thorax. As is familiar to every one, a certain volume of air can be expelled from the thorax by forcible compression of its walls; on the removal of the pressure, the walls of the chest return to their former position in consequence of their own elasticity, and air rushes into the lungs in order to fill up the vacuum thereby produced. Consequently, by a regular repetition and relaxation of pressure, a species of artificial respiration may be induced, the volume of air inhaled and expelled varying with the amount of the pressure.

When manual pressure equal to about 30 lbs., which is not greater than may be with perfect safety applied to an adult human subject, is made over the lower part of the sternum and upper and middle portion of the abdomen, from 8 to 20 cubic inches of air are expelled, and readmitted on the relaxation of the pressure; and by repeating this twenty or thirty times in a minute, sufficient oxygen may be obtained to support life.

In making the abdominal pressure, care is to be taken to observe if any food is forced out of the stomach, which may happen if that viscus is full; and if so, it is necessary that care be taken to prevent it getting into the windpipe. This may be readily done by placing the patient for a few seconds on his face and forcibly expelling the food.

The pressure ought not to be made on the upper part of the sternum, for the resilience of the thoracic walls there is not great enough to allow of the expulsion of sufficient air for the purpose of respiration; nor is the pressure on the abdomen to be omitted, else the diaphragm will descend, and counteract the benefit derived from that made on the lower part of the chest.

Dr. Marshall Hall's method of performing artificial respiration. The method of imitating natural respiration recommended by the late Dr. Marshall Hall is too well known for us to take up time in describing it; we may simply mention that it consists essentially in "turning the body gently on the side and a little beyond, and then briskly on the face, alternately;" and in making pressure along the back of the chest each time the body is brought into the prone position. Within the last year or two this method has been largely practised throughout the country, and most favourable reports of its efficacy have from time to time been published by different gentlemen in the weekly periodicals. Notwithstanding this, however, we must admit that we are extremely sceptical regarding its advantages; and we are doubtful if the recoveries which are reported as having taken place under its use have been attributed to the proper cause. But lest it should be thought that we have an improper bias for any particular method, we shall, in preference to giving our own views regarding the comparative value of the Silvester and Marshall-Hall methods, give the published opinions of the Medical and Chirurgical Society's Committee, with which our own entirely accord. The committee applied the "ready method" and the "physiological method," as they were termed by their respective proposers, to a number of recently dead human subjects in exact accordance with the published instructions by the authors; and the conclusions they arrived at are the following:*

"As regards that part of the method which consists in turning the body alternately 'very gently on the side and a little beyond, and then briskly on the face,' it was found that the volume of air exchanged was variable in the same subject; but always inconsiderable. It usually happened that a quantity of air, varying from 1 to 8 cubic inches, never more, generally much less than 8, was inspired when the body was turned from the supine posture to one side. When the body was placed on the abdomen with the head resting on the forearm, a somewhat larger quantity was expelled, never exceeding 10 cubic inches. On restoring the body to the lateral posture, the amount of air inspired was usually less than that which had been expelled by pronation. But the quantity expelled and inspired in each movement was scarcely ever precisely equal.

"The volume of air expelled when the body was placed on the face was much increased if pressure was at the same time made on the spine, the amount of this increase varying according to the degree of the pressure; and in those experiments in which such pressure was made, it was found that the quantity of air which was inspired on rotation of the body to the side was much less than that which had been expelled by pressure.

"As regards the whole amount of exchange of air produced by the method of Dr. Marshall Hall, 'to imitate respiration,' it varied much according as the subject was favourable or the contrary, sometimes not exceeding a few cubic inches, but never exceeding 15 cubic inches."

Physiological method recommended by Dr. Henry R. Silvester. Dr. Silvester's method consists in the imitation of the action during deep inspiration of the pectoral and other muscles passing from the shoulders to the parietes of the chest. The inspiratory effort is imitated by slowly extending the arms upwards by the sides of the head until the elbows nearly touch each other. The expiratory effort is performed by restoring the arms to the sides of the chest, and slightly pressing them against it.

In performing Dr. Silvester's method on the same subjects that were either previously or subsequently employed in practising the "ready method," the Committee "found that, on extending the arms upwards, a volume of air was inspired into the chest which varied, in different subjects, from 9 to 44 cubic inches; and it was observed that the results obtained in successive experiments on the same body were remarkably uniform, in which respect, as well as in their quantity or amount, they contrasted with those obtained by

the method of Dr. Marshall Hall. On restoring the arms to the side, as directed by Dr. Silvester, the quantity of air expelled was generally nearly equal to that previously inspired; occasionally less.

"Dr. Silvester recommends that on bringing down the patient's arms they should be gently and firmly pressed against the sides of the chest, so as to diminish the cavity of the thorax. It was found that this pressure could be exercised with greater facility, and equal effect, by placing the hands on the lower third of the sternum, as already above described. By alternating the movements of the arms with pressure of this kind, a regular exchange of air was produced, the quantity of which, in several instances, exceeded 30 cubic inches, and in one instance amounted to 50 cubic inches. In those cases in which a less respiratory effect was produced, the deficiency was always distinctly attributable to unfavourable conditions, particularly the existence of obstructions in the respiratory passages.

"Without expressing an opinion as to the efficacy of the method of Dr. Silvester as a means of restoring suspended animation in cases of drowning, its claims to be considered as an effectual means of producing an exchange of air similar to that effected by the respiratory movements appear to us to be satisfactorily established. As has already been pointed out by Dr. Silvester, the condition of the thorax after the cessation of breathing being that of expiration, it is desirable that the first step in the restoration of breathing should be a movement of expansion; in this respect the method he has proposed enjoys a marked superiority over that of Dr. Marshall Hall, which has for its object to force air from a chest which has already discharged its natural quantity. It also appears to be an important advantage in this method, that, in each movement of expansion, both sides of the chest are left free from compression, and therefore free to move, while the postural method of Dr. Marshall Hall leaves only one side free to expand. As regards facility and readiness of application, there is also no doubt that the method recommended by Dr. Silvester is at least equally if not more effective than the Marshall-Hall plan."

The Committee further made the following important observations on

Artificial inflation of the lungs through the mouth. "A few experiments were performed relating to the efficiency of the inflation of the lungs through the mouth of the subject, which led to the conclusion that with proper precautions such inflation is perfectly practicable. The following were among the results noticed:

"1. As regards the position of the tongue and its influence in impeding the entrance of air, it was found that in the dead body this organ is apt to offer great obstruction to inspiration by falling back into the pharynx and closing the laryngeal aperture. No air could be forced through the mouth in a body lying on the back so long as the tongue remained undisturbed; but when it was drawn forward and held out of the mouth by a ligature, or by the pressure of the teeth upon it, air could be injected by the œsophagus and larynx, so as to distend both the abdominal and thoracic cavities. On leaving the tongue loose in the mouth, and allowing it to fall back by its own weight, air could also be introduced; but much less freely than when it was drawn forwards. Complete obstruction to the passage of air was produced by pressing the tongue back into the pharynx, no air entering either the larynx or œsophagus.

"When the head of the subject was allowed to hang back over the edge of the table, air seemed to pass into the chest more readily than when the back of the head rested upon the table.

"2. It was found that the whole quantity of air introduced by inflation could be compelled to enter the respiratory cavity by pressing back the larynx against the spinal column. By this expedient the passage of air down the œsophagus was at once intercepted; while its transit down the trachea continued to take place as freely as before, so that it affords a ready means of preventing the passage of air into the stomach during artificial respiration.

"3. During inflation of the lungs, a sound closely resembling that of the ordinary vesicular murmur is plainly heard, proving that air enters not merely the larger air-passages, but the vesicular structure of the lungs. Marked expiratory murmur was also heard during the recoil of the lungs and thoracic parietes after inflation. In cases where the bronchial tubes were obstructed by secretion, the various kinds of crepitation could be distinguished.

"*Rigor mortis.* The effects of rigor mortis were judged of by observations on one subject especially. It was observed that, after prolonged experiments, the rigidity, which at first existed in a marked degree, was completely overcome and abolished by the repeated movements of the arms and thoracic parietes. As this change took place, the quantity of air inspired and expelled increased, so that at the end of the period of observation the results were nearly twice as large as they were at the beginning."

The Committee summed up its labours by making the following suggestions regarding the treatment of apnoea generally; but in giving to them all due consideration, it must be borne in mind that the investigations of the Committee related only to two forms of apnoea,—that produced by a simple mechanical obstruction to the entrance of air into the lungs, and that produced by drowning. Its conclusions are as follows:

"That all obstruction to the passage of air to and from the lungs be at once, so far as practicable, removed; that the mouth and nostrils, for example, be cleansed from all foreign matter or adhering mucus.

"That, in the absence of natural respiration, artificial respiration, by Dr. Silvester's plan, be forthwith employed in the following manner: the body being laid on its back (either on a flat surface, or better, on a plane inclined a little from the feet upwards), a firm cushion, or some similar support, should be placed under the shoulders, the head being kept on a line with the trunk. The tongue should be drawn forward, so as to project a little from the side of the mouth; then the arms should be drawn upwards until they nearly meet above the head, the operator grasping them just above the elbows, and then at once lowered, and replaced at the side. This should be immediately followed by moderate pressure with both hands upon the lower part of the sternum. This process is to be repeated about twelve or fourteen times in the minute.

"That if no natural respiratory efforts supervene, a dash of hot water (120° Fahrenheit) or cold water be employed, for the purpose of exciting respiratory efforts.

"That the temperature of the body be maintained by friction, warm blankets, the warm bath, &c.

"In the case of drowning, in addition to the foregoing suggestions, the following plan may be, in the first instance, practised: place the body with the face downwards, and hanging a little over the edge of a table, shutter, or board, raised to an angle of about 30°, so that the head may be lower than the feet. Open the mouth and draw the tongue forward; keep the body in this position for a few seconds, or a little longer if fluid continues to escape. The escape of fluid may be assisted by pressing once or twice upon the back."

Having said thus much on the general bearings of treatment in cases of apnoea, we have now to consider some of the special bearings as applicable to particular cases. It will be remembered that we classified the different forms of apnoea under the four heads of—that arising from a mechanical impediment to the entrance of air into the lungs, that produced by drowning, that caused by an absence of oxygen in the inspired medium, and that due to the inhalation of a toxic gas or vapour. As regards the first of these causes; it ought never to be forgotten that apnoea may arise from mechanical causes, and yet, *even while the cause exists*, it may fail to be detected, and the patient be allowed to die in consequence. This happened not long ago. A cabman, sitting on the step of his cab, eating his dinner, was suddenly hailed by a fare. He jumped up, pushed the remainder of his meal into his pocket, sprang on to

the box and seized the reins, when immediately afterwards he was observed to become livid in the face, and with scarcely a struggle fell back insensible on his seat. A hospital being close at hand, he was instantly conveyed thither; but although only a few minutes had elapsed, he was found to be dead almost as soon as he was brought into the waiting-room. The case was thought to be one of apoplexy, and was treated as such; that is to say, nothing was done; no attempt at resuscitation was made; and it was not until the autopsy revealed the true cause of death that the idea occurred that the man's life might have been saved. A piece of unchewed meat was found sticking in the throat and plugging up the opening into the larynx. There can be but little doubt that if this had been discovered and removed when the man was first brought into the hospital, its removal, in all probability, would have been followed by recovery, either with or without artificial means. Cases of this kind are not so very uncommon. Several have been reported in the journals.* It ought also to be borne in mind that suicide and even murder have been committed by thrusting substances into the fauces. A pocket-handkerchief is said to have been the instrument in one case; a ball of cotton in another.

It also occasionally happens that children are suffocated in attempting to swallow their playthings. In 1851 we saw Trousseau rescue a child from impending death by the timely performance of tracheotomy, and the extraction of a cherry-stone which had become lodged in the trachea. It is not necessary even that the plaything enter the trachea; if it be of considerable size, as in the case of a whistle, it may stick in the œsophagus, and by its pressure on the trachea obstruct the entrance of air into the lungs.

Feeble children, and still more frequently intoxicated adults, have been suffocated from food ejected out of the stomach getting into or blocking up the orifice of the trachea. A drunken man perished once after vomiting, from a piece of potato-peel covering the glottic orifice. The cause of death remained unknown until it was revealed at the post-mortem examination.†

On more than one occasion it has happened that not only during life, as in the above cases, but even after the autopsy, and until a second and more searching examination of the body has been made, the true cause of the apnœa has failed to be detected.

It may be useful, perhaps, to know that in nearly all cases of plugging of the respiratory passages, a clue may be obtained to the mischief by the lungs refusing to collapse on the chest being opened. This of course arises from the air contained in them being unable to find an exit in the usual way.

As regards the accidental suffocation of children by bedclothes, or wearing-apparel too closely covering their faces, we would remark that this accident, which has occasionally arisen from excessive care as well as excessive carelessness, the practitioner is in some cases able to remedy. Cases of this kind, when seen sufficiently early, are admirably adapted for treatment by artificial respiration. There being no violence or injury of any kind either to the air-passages or to the lungs, death arises from non-arterialisation of the blood in one of its least complicated forms. So that, if the heart's action is still perceptible, no matter how feeble it may be, the chances of recovery by artificial inflation are exceedingly great. We have just said that this accident may happen from excessive care; a good example of this occurred not long ago. A young mother, while carrying her first-born to church to be baptised, in order the more effectually to protect it from the cold, turned up the end of her shawl, and drew it over the infant's head. On arriving in church and uncovering her charge, she for the first time discovered that her excessive care had proved fatal to her child.

* In University College Museum is a preparation which illustrates admirably how firmly the larynx may get plugged with a fragment of unchewed meat.

† *Edin. Med. and Surg. Journ.* 1844.

In a case of this kind inflation should be had recourse to, even after the heart's action has stopped ; and it should be continued for at least a quarter of an hour or twenty minutes. We have seen new-born children recover after that period from suffocation.

Artificial respiration in infants is to be done differently from any of the modes we have hitherto described. The muscles of the new-born are not sufficiently developed to make the Silvester method effectual ; and as for the Marshall-Hall and the manual-pressure methods, in cases of still-birth they are simply impossibilities ; for as the child has never breathed, there is no air in the lungs to expel, either by one or the other method. Even if the child has breathed, the thoracic walls are scarcely sufficiently strong and elastic to enable these methods to be adopted with much prospect of success. In children, at least under six months old, mouth-to-mouth inflation is by far the simplest and most effective mode of artificial respiration.

The operation is best performed by placing the child on a pillow on the table, with its head to the operator's left hand. The operator, placing himself on a chair, after wiping the mouth and nostrils clean, should seize the larynx between the thumb and forefinger of the right hand, and press it gently but firmly upwards and backwards. This is done with the object of facilitating the entrance of air into the lungs, and at the same time preventing any passing down the œsophagus into the stomach. The nostrils are then closed with the left hand, and the operator proceeds to distend the child's lungs with air by placing his lips over its mouth and blowing steadily into it. Having done so, he removes the hand from the larynx and gently aids in the reëxpulsion of the air from the lungs by pressure on the lower part of the sternum. This is to be repeated twenty or five-and-twenty times in the minute. We have frequently adopted this method, even on premature children, with perfect success. As an example of this mode of procedure, the following case, which to us is one of more than usual interest, may be related:

In 1850, while house-surgeon to the Royal Maternity Hospital in Edinburgh, we extracted a child by the Cæsarean section after the death of the mother. It was only a seven and a half months' child, and on extraction neither pulsation in the cord, nor the slightest movement of the heart, was perceptible. Mouth-to-mouth inflation was immediately had recourse to in the manner above described ; and after at least ten minutes' labour it succeeded in restoring the heart's action, which was soon afterwards followed by respiratory movements, which, though feeble for a time, soon became sufficiently strong for the purposes of life. Although fourteen years have elapsed since then, the individual is still alive, and is now a fine healthy boy.

It is sometimes no agreeable task to apply the mouth to that of another. In that case a flexible or a metallic catheter may be passed into the trachea, and tightly held there by the finger and thumb placed on the neck, while air is blown through it into the lungs. The only difficulty here is the getting the instrument into the larynx ; but that is easy enough if the operator will only remember to take the precaution to push the larynx upwards and backwards as before described, and then glide in the catheter with its point tilted forwards. The catheter will be known to be in the trachea, and not in the œsophagus, by our capability of moving the larynx from side to side by its means.

In cases of apnoea from inflammation of the fauces, excited by drinking boiling-water, inhaling steam, or swallowing escharotic fluids, it is better, before attempting artificial respiration, at once to perform tracheotomy. For when the inflammation or disorganisation is sufficiently severe to prevent the entrance of air by the natural thoracic movements, it is not at all probable that artificial means will be more successful in surmounting the obstacle to its admission. The same remark is equally applicable to cases of diphtheria and croup.

In cases of attempted death by strangulation, the Surgeon may be called upon to treat something else than mere apnoea. If much force has been em-

ployed in constricting the neck, there may be considerable injury done to the larynx. The os hyoides may be fractured; the laryngeal cartilages broken, especially in old persons, in whom they have become ossified; moreover there may be contusion, and even laceration, of the soft parts of the neck. As an illustration to these remarks, the following case of impending apnœa arising from fracture and displacement of the os hyoides may be cited:

On the 28th March 1856, a little girl, aged six years, while jumping, fell with her neck across the rail of an iron bedstead. She was instantly seized with a fit of coughing, great dyspnœa, an inclination to vomit, and a copious flow of saliva. The saliva was partly tinged with blood. When brought to us, which was almost immediately after the receipt of the injury, there was distressing difficulty in breathing, the face was of a livid blackness, and there were all the other symptoms of impending death by apnœa. On examining the neck, there was found a sharp body projecting beneath the skin. It was very angular and quite movable. On close inspection it was found to be the displaced ends of the fractured hyoid bone. One end of the body rode over the other. By a little manipulation the fracture was reduced, and all the symptoms of impending suffocation, together with the copious flow of saliva, &c. rapidly subsided. A bandage was placed round the neck to keep the ends of the bone in their place; and with the exception of a smart attack of fever, which lasted three days, the child made an uninterrupted recovery, and without any deformity except a slight fulness caused by the callus; but even this after a time disappeared.

Death from apnœa arising from disease may give origin to precisely the same train of symptoms as that supervening upon an accidental mechanical obstruction to the respiratory process; the only difference being that the symptoms in the former case usually progress very slowly, as, for example, in cases of death from apnœa caused by œdema of the glottis; from the trachea becoming blocked up with a false membrane, as in diphtheria and croup; from the accumulation of mucus, as in bronchitis; from insufficient healthy pulmonary tissues remaining to admit of the blood becoming arterialised, as in pneumonia; and from compression of the lungs from effusion, as in double pleurisy.

In all these cases there is one remarkable circumstance observable, namely, that the lividity and congestion of the face are almost, if not quite, as apparent as in cases arising from a ligature round the neck, by which the descent of the blood through the jugular veins is interrupted. The same remark is equally applicable to cases in which the disease is external to the trachea; as, for example, in cervical tumours, aneurism, hypertrophied thymus, &c., which produce apnœa by their pressure on the trachea.

The explanation of this is simple enough. First, the face and lips are livid from the arteries conveying venous instead of arterial blood; and secondly, they are congested on account of the circulation being arrested in the lungs, which causes the right side of the heart and the large veins opening into it to be engorged; and these, in their turn, produce congestion in the vessels opening into them.

It is on account of this congestion of the vessels of the head and neck, that bleeding has occasionally been had recourse to; and although it cannot be recommended as a means of removing the apnœa, yet we see no reason for condemning it *in toto*, as some recent writers have done. On the contrary, although we would not advise it to be practised as a general rule, we nevertheless think that the abstraction of a moderate amount of blood from the right jugular vein may be sound treatment in certain cases of apnœa. It will have the advantage of relieving, for a time at least, the congestion in the vena cava superior, and thereby facilitating the contractions of the over-distended and thereby weakened heart. On opening animals immediately after death by apnœa, we have frequently seen the arrested heart's action recommence, and continue regular for at least a quarter of an hour after we had punctured the vena cava and thereby relieved the engorged cardiac organ of

some of its blood. The heart is exactly like the bladder ; whenever it is over-distended, it ceases to be able to contract upon its contents. In thus recommending bleeding from the jugular vein in certain cases of apnoea, we desire it to be distinctly understood that the abstraction of blood is only to be regarded in the light of an auxiliary to the other treatment, and to be in no case practised except in plethoric subjects ; for in those of an opposite constitution all the blood they possess is required to carry them through the dangerous period of secondary apnoea.

It has been argued that if bleeding is serviceable at all, it ought to be particularly so in cases of strangulation and hanging where urgent symptoms of cerebral congestion are frequently observed. No doubt this view is correct ; but the bleeding must not be carried too far, for experience has taught that in these very cases, after the first insensibility has been temporally recovered from, the bleeding has neither prevented the supervention of stertorous breathing, convulsions, coma, nor even death itself.

As regards treatment in cases of drowning, we desire to call special attention to the fact, that all persons who die in the water are not necessarily drowned. A man labouring under heart-disease may suddenly expire from the thoracic shock received in coming violently in contact with the surface of the water. Persons falling from a height have died from concussion of the brain and extravasation of blood under the arachnoid.

On the other hand, persons have died of apoplexy while bathing ; and not long ago the brother of a medical man died from an epileptic seizure which was supposed to have come on during the act of diving. This occurred in one of our public baths, where he was in the habit of practising swimming. On the occasion in question he was seen to dive, as he usually did on first entering the water ; but as he never rose again, a search was made, and his lifeless body was found lying at the bottom of the bath. The gentleman had suffered from epileptic attacks for several years.

While guarding against an error in treatment from mistaking epilepsy for drowning, one must be equally cautious not to fall into the opposite error of mistaking the convulsions of apnoea for those of epilepsy ; for they may occur in cases of drowning, as well as in any of the other forms of death from a cessation of the respiratory process.

As regards prognosis in cases of drowning. It may be laid down as a rule, that the more complete the submersion the more fatal the case ; for after the person is completely submerged, frequent attempts at respiration continue to be made, with each of which air and frothy water are expelled from the lungs, and water enters. This goes on until the person is exhausted and all attempts at respiration cease. For example, a person completely submerged for one single minute and a half has a much slighter chance of recovery than one who has struggled about in the water for ten minutes or more, even although the former when taken out is still making efforts at respiration, and the latter has ceased to do so. Of course it is taken for granted that in the latter case the heart's action still continues, and the respiratory movements have only just ceased. The heart's action continues for from two to four minutes after respiration has stopped ; and so long as the impulse of the heart is perceptible, resuscitation is not only possible, but probable.

By referring to the physiology of drowning, the grounds upon which this assertion is based will be at once evident. It may be added, as a second general rule, that the more rapid the cessation of the respiration in cases of drowning, the less is the chance of recovery—which is exactly the reverse of what happens after apnoea from mechanical obstruction. The reason of the greater likelihood of death after a rapid stoppage of the respiratory movements in drowning, is that it usually arises from a very sodden condition of lung ; and in proportion as the lungs are sodden with water are the chances of recovery diminished. When the person has gone on struggling for some length of time, and occasional imperfect inspirations have been obtained, he at length sinks from the combined effects of exhaustion and apnoea, and the

lungs are not then in the sodden condition met with in cases of entire and continued submersion. This, too, is the reason why the lungs of human beings seldom or never exhibit the excessively sodden condition met with in animals sacrificed for experiment.

The object of suspending drowned persons by the heels for a second or two is to permit of the exit of the water from the trachea and bronchi; and the plan is no doubt, in certain cases, a good one.

As regards the treatment of cases of apnœa from simple absence of oxygen in the inspired medium, we have no special remark to make, except that artificial respiration is the only treatment required.

While regarding the cases of semi-apnœa and semi-poisoning of the fourth group of the classification, we have to observe that, if possible, artificial respiration is more imperatively demanded in them than in any of the other cases we have hitherto been considering, for the simple reason that not only is oxygen required to be put into the circulation, but the poisonous gas to be taken out; and there is no readier means of attaining this object than by artificial respiration. All gaseous and volatile poisons are much quicker eliminated by the lungs than by any other channel. A most striking illustration of this can be given in the experiment first proposed by Bernard, and which we have several times repeated with results precisely similar to those obtained by its inventor.

Sulphuretted hydrogen, when inhaled, is rapidly fatal to animal life; whereas if instead of allowing the gas to enter the circulation by means of the lungs, it be mixed with water and injected into the jugular vein, it fails to produce any toxic effect. And why? Merely because it is *exhaled* by the lungs during its passage through them, and it is thereby prevented from getting into the arterial current. So rapid is the exhalation of the gas, that if a fragment of white paper moistened with the acetate of lead be held in front of the dog's nose, within four seconds after the injection of the gas into the jugular vein, it reappears in the expired air; as is proved by the black sulphuret of lead which forms on the paper the moment the breath comes in contact with it.

This experiment is sufficient of itself to prove the value of artificial respiration as a means of eliminating volatile poisons from the circulation; so that it is unnecessary for us to enter into the question of the pulmonary elimination of ether, chloroform, or any other volatile vapour or gas; the results obtained by experiments being identical in all cases, as far as they have been yet tried.

It only remains for us now to put before our readers in a tabular form the general rules which should guide them in the treatment of cases of apnœa, the fundamental object of which is to arterialise the blood as rapidly as possible. The Royal Humane Society's rules are so admirably drawn up, that we have only to modify them a little in order to give to them the wider application demanded by the general question of apnœa.

Galvanism has been frequently proposed as an aid to recovery in cases of suspended respiration; but as the grounds on which its supposed benefits rest are somewhat vague, they need not be here entered upon. The advantages derivable from the remedy may be summed up in a very few words. In the first place, it is to be borne in mind that artificial respiration cannot be kept up by galvanic influence alone. Galvanism can only be employed as a direct reëxciter of normal respiratory movements and reawakener of the heart's action, when that organ has ceased to pulsate. For these purposes it is best employed in conjunction with artificial respiration; and is most readily applied by placing one pole in the upper sternal or lower cervical region, and the other immediately over the diaphragm. The galvanic shocks ought not to be too frequent nor too prolonged; and when they visibly fail to restore the normal respiratory movements and cardiac action, this agent ought to be laid aside, as its continued use tends to exhaust the vital energies.

Rules of treatment in cases of impending death by apnœa. 1. All froth and

mucus, of which there is usually a considerable quantity, are to be immediately removed from the mouth and nostrils; and should the case be one of drowning, in addition to the removal of the mucus from the mouth and nose, the legs and trunk of the patient are to be raised for a few seconds above the head and shoulders, in order to allow of the exit from the trachea and lungs of any free fluids that may be present in them.

2. All tight articles of clothing are to be at once removed from the neck and chest. For example, the cravat is to be taken off, the shirt unbuttoned, the corset unloosened, &c.

3. Should it happen that the patient is already so nearly dead that his tongue sinks back into the fauces, and is thereby likely to interrupt the entrance of air into the trachea, it is to be drawn forward, and, if necessary, held there.

4. If the respiratory movements have ceased, or become few and feeble, artificial respiration is to be performed by manual pressure, or by the Silvester method.

N.B. In order to do this readily, place the patient on his back upon a flat surface, with a pillow or cushion under the shoulders, for the purpose of arching the back slightly; and if manual pressure is the method adopted, it must not be forgotten that the pressure is to be made simultaneously on the lower part of the chest and middle of the abdomen.

5. Should the apnoea be the result of mechanical constriction of the chest, as from a fall of earth or stones, by which one or more of the ribs may have been broken, the manual pressure and the ready methods are to be avoided, and artificial respiration by means of the Silvester method employed in their stead.*

6. As soon as natural respiratory movements recommence, cease the employment of artificial means, unless the efforts are feeble and imperfect, when they may still be aided for a time with advantage.

7. As soon as the patient is capable of swallowing—and sooner, if a stomach-pump is at hand—administer a cupful of warm coffee or tea, with a couple of drachms of spiritus etheris nitrici in it; or if that is not at hand, a table-spoonful of brandy or other spirit.

8. Use warm frictions all over the body, more especially on the limbs, to aid the circulation; and the more the skin is exposed to dry warm air the better, as even the cutaneous respiration aids in the arterialisation of the blood.

9. When the temperature of the body is much reduced, as in cases of drowning during the cold winter months, try and restore it by means of a hot-water or air-bath. If by the latter, place the head of the patient so as to keep the rarefied hot air from entering the lungs. Artificial respiration by pressure and frictions with the hand can both be readily applied while the body is in the warm bath.† The bath should not be too hot (not above

* If there be sufficient assistance at hand, the Silvester method may be followed in all cases in which artificial respiration is considered necessary; but where the medical attendant is alone, the method by simple pressure is the quickest and easiest that can be adopted. It only differs from the Silvester method in this respect, that in it the air is forcibly expelled from the lungs, and allowed to enter, in consequence of the vacuum produced in the thorax by the reëxpanding of the walls by their own elasticity; while in Silvester's method the air is forcibly inhaled and then expelled by the natural resilience of the ribs. In both cases the respirations should amount to twenty, thirty, or even forty per minute. The natural respirations are only eighteen per minute; but in cases of resuscitation, our object is to arterialise the blood even more rapidly than in health; and as we cannot introduce by artificial means the same amount of air that is taken in by the normal efforts, we must increase the number of our respirations.

† In the case of a young woman, one of the fourteen who were nearly drowned in the water at the Regent's Park a few years ago, in consequence of slipping into a hole in the ice, the body was so excessively cold, and the limbs so stiff, that as

106° F.), as it is not desirable, for the reasons formerly given, to raise the bodily temperature above its normal standard. Nor should the body be retained in it after the temperature has been restored; for, as was before said, the more the skin is exposed to the air the better.

Treatment after the breathing has become natural. 1. Give the patient some warm nutriment, to which a small quantity of stimulant is added; beef-tea, chicken-soup, coffee, or simple tea with one or two table-spoonfuls of brandy.

2. Put him into a well-aired bed with hot bottles to his feet, and encourage sleep.

3. Let him be carefully watched during sleep in case of secondary apnoea; at the slightest symptom of which let gentle frictions and, if necessary, artificial respiration be again had recourse to. Give volatile stimulants, such as the spiritus ammoniæ aromaticus, or spiritus etheris nitrici.

In the case of the drowned, the following might be said to be the four golden rules of treatment:

1. Empty the air-passages of all the water and frothy mucus they may chance to contain, by holding the legs and trunk higher than the head.

2. Wipe the mouth and nostrils dry.

3. Draw forward the tongue.

4. Use artificial respiration.

GEORGE HARLEY, M.D.

ON PARASITES, AND THE DISEASES WHICH THEY PRODUCE.

UNDER the term "parasites" might properly be included all the organised beings which exist during a part or the whole of their life at the expense of other living animals or plants. In this sense an innumerable host of creatures would be included under the term, belonging to both the animal and vegetable kingdom. These have been divided into *true* and *false* parasites; and the former have even, by some writers, been erected into a distinct class, or rather into distinct classes, under the names of ento- and epi-zoa, or ento- and epi-phyta; but, in a scientific point of view, it is obviously improper to maintain any such classification.

Parasitism is to be regarded more as an accident than as an essential attribute; and the mere circumstance that an organism lives at the expense of another living one affords no valid distinction between it and others whose nutriment is derived from dead organic matter. It is, moreover, now universally admitted that all the so-termed entozoa, &c. belong to some one or other of the larger groups of non-parasitic forms already contained in either kingdom. In the case, for instance, of parasitic animals, we find not only that they nearly all belong to the sub-kingdom annulosa, but that they also fall into existing classes. The most that can be said of any among them is that they appear to constitute groups of ordinal value.

In any general account of the subject, therefore, parasites would have to be regarded in their relations to numerous closely allied forms; and the study, consequently, would be one of very great extent. It is one also, from

soon as she was brought into the tent which was being used as a temporary receiving-house, she was instantly put into a warm bath, without waiting to take off her clothes, and artificial respiration by manual pressure at once commenced. It was, however, found impossible to obtain any result with her stays on; so they were slit open, but not removed, and the artificial respiration at once recommenced. In about twenty minutes the patient was so far recovered as to be able to give her address. In this case, when brought into the tent, the girl appeared to be perishing as much from the effects of cold as from apnoea.

many circumstances connected with their life-history, of extreme interest both to the naturalist and the physiologist. Here, however, we have to do almost exclusively with the Surgeon; and the limits and objects of an essay like the present preclude both the possibility and the necessity of considering the subject in any such extent. We propose, in the brief space at our disposal, to give an account only of those parasites the consequences of whose invasion are likely to be brought under surgical treatment; and in doing this to enter only so far into their natural history as may be necessary for the suggestion of curative or prophylactic measures.

Classification of parasites. In the first place, they belong either to the animal or vegetable kingdom. We will commence with the former.

Animal parasites. Arranged in zoological order, these are found in the following classes:

- I. Infusoria.
- II. Annuloida.
- III. Arachnida.
- IV. Insecta.

I. *Parasitic infusoria.* Four or five minute organisms belonging to the heterogeneous group of *infusoria* have been described as occurring in the human subject. They belong to the families monadina and holotricha. The former includes all infusory animalcules presenting a simple and apparently homogeneous body furnished at one end with one or more elongated vibratile filaments. The family, however, is a very doubtful one in its relations to the animal kingdom, and it is pretty certain that the majority, if not the whole, of the monadina merely represent the motile zoospores of various algæ or fungi. It is also extremely doubtful whether they should in any case be regarded as parasites, and not rather as merely the concomitants of putrefaction.

The supposed parasitic monadina belong to the genera *cercomonas* and *trichomonas*; the former, characterised by the presence of a single vibratile filament, and the latter by that of two or more. The species of *cercomonas* noted as parasitic are, *C. intestinalis*, *C. urinarius*, and *C. saltans*. The situations occupied by two of these forms are sufficiently indicated in their names, whilst the last is described as occurring in the discharge on the surface of foul sores.

Trichomonas. The only species (*T. vaginalis*) referred to this genus presents points of rather more interest. Originally noticed by M. Donné* in the mucus of the vagina, he at first supposed it to be diagnostic of a gonorrhœal discharge. But subsequent observations by himself and others have shown that this is not the case. In fact, according to Kolliker and Scanzoni, it was found in the majority of the women examined by them, either pregnant or not. Its presence would appear, nevertheless, always to be accompanied by some morbid condition of the vaginal secretion, though that need not be exclusively of a specific nature. It is to be remarked, moreover, that its habitat is exclusively the vagina, as it is never found even in the cervix uteri. The animalcules vary in length from 0.008^m to 0.018^m, and they are usually furnished, in addition to the whip-like appendages, with a few cilia at their base. In their natural nidus they exhibit active movements, which, however, soon cease on the addition of water, in which they swell up into a spherical form, and assume very much the appearance of ciliated epithelium-cells, for which they have sometimes been mistaken.

In the family holotricha, among the true ciliated infusoria, the only parasitic form observed, if it really deserve the name, is a species of *paramacium*, described by Malmsten as occurring in the cæcum and colon.

II. *Parasitic annuloida.* Dividing the annulosa into three primary groups

* *Recherches Microscopiques: Sur la nature du mucus*, 1837, and *Cours de microscopie*, 1847, pp. 157-161, fig. 33.

or provinces, viz. the arthropoda, annulata, and annuloida, we shall find that all the more important parasites belong to the first and last, which alone includes almost all the true entozoa. In the arthropoda, the classes arachnida and insecta both afford instances of occasionally or permanently parasitic species; whilst in the annuloida, or most lowly organised division, in which we include the scolecida, geophyrea, echinodermata, and rotifera, they are found only among the first. The orders included in this class are,

- | | | |
|-------------------|---|-------------|
| 1. Tæniada | } | Platyelmia. |
| 2. Trematoda | | |
| 3. Turbellaria | | |
| 4. Acanthocephala | } | Nematelmia. |
| 5. Nematodea | | |
| 6. Gordiacea | | |

With the exception perhaps of the turbellaria, all of these orders may be regarded as composed of parasitic creatures.

(a) *Platyelmia*, or flat worms. The members of this sub-class are characterised by a more or less flattened body, usually very short, but in some cases, as among the turbellaria, of considerable length. They are generally furnished with external appendages for the purpose of motion or of attachment, and consisting in some cases of suckorial discs or acetabula, in others of hooks of various kinds, or of both combined. Most of them are hermaphrodite, and in many the course of development presents strange and peculiar phenomena. With respect to their organisation it may be stated generally that the platyelmia have no proper visceral cavity, the body being composed as it were of a solid parenchyma, in which the viscera and muscular tissue are closely imbedded. On this account some among them have been termed sterelmintha. Considerable diversity exists in their alimentary system; for while some have a complete canal with oral and anal orifices, and a protrusile pharynx, in others the anus is wanting, and the mouth a mere pore, and in some, which are endoparasites throughout their existence or nearly so, no trace of mouth or alimentary canal exists; the nutrition of the worm being carried on through the external surface. None possess any true blood-vascular system; but in all there is a distinct system of so-termed "water-vessels," probably of a renal or excretory nature, and which in some pervades the entire body with its fine reticulations, in the ultimate extremities of which are lodged minute calcareous or phosphatic particles. The nervous system is either wholly inapparent or very rudimentary.

Tæniada,—*tape-worms*. In this order, which has sometimes received the name of cestodea, are included also the so-termed cystica, or cyst-worms, the reason for which will be apparent from what follows. In addition to the characters they possess in common with all the platyelmia, the tæniada may be distinguished by the following. They have neither mouth nor intestine; and in the mature or sexual condition are united into a continuous band or chain, originating in an individual, which itself never reaches sexual maturity, but continues to throw off a succession of buds or gemmæ, each of which becomes a perfect hermaphrodite individual, though remaining attached to the colony of which it forms a link for a considerable length of time. The separate individuals constituting this compound growth become more and more developed as their distance from the primary joint increases, until, having reached full maturity, they are successively detached, either spontaneously or accidentally, and pass out of the body with the feces. The primary individual remains all the time attached to the intestinal mucous membrane of the host by one or other of the organs mentioned above. This individual is termed a scolex, and each separate joint or sexual individual budded from it a proglottis. This is the condition of the entozoon when it forms what is termed a tænia, or tape-worm, which consequently must be taken to represent a chain or continuous succession of distinct individuals gradually arriving at sexual maturity, and then thrown off. In this state it is always found within the intestinal canal, or, as in some fishes, in diverticula

from it. In another condition, however, the tænioid entozoa are invariably found in the parenchymatous tissues of the body external to the intestinal tract; but here they exhibit a totally different aspect, constituting, in fact, the so-termed cystica, or cyst-worms. It is also a remarkable circumstance that, so far as is known, with the exception of the human subject, the tænioid and the cystic states of the same species are never found in the same animal. The cyst-worms of one animal give rise to tape-worms in another, and *vice versâ*; and what is equally remarkable is the fact that these are in almost all cases reciprocally herbivorous and carnivorous or omnivorous species. As, for instance, the cyst-worm of the sheep or rabbit will produce tape-worms in the dog and cat; those of the pig and ox become tape-worms in man, &c. This curious state of things arises in the following way: The mature proglottis of the tænia is filled with ova, each of which, within a firm and peculiarly resistant shell, contains a minute active embryo, which, from its being armed with six hook-like boring implements, has been termed a "six-hooked embryo," or "hexacanthus." For the exclusion of this embryo, it appears, from repeated observations and experiments, to be necessary that the ovum should be subjected to the solvent action of the gastric juice in the stomach, usually of another species of animal than that in which the proglottis was nurtured. But when thus liberated from its durance the "hexacanthus" speedily makes its way through the walls of the intestine of its new host and effects a lodgment in the tissues of the body, after a migration of greater or less extent. Having reached its ultimate destination, the hooks are thrown off, and the embryo is transformed into a cyst-worm, which differs according to the species of tape-worm from which it originated. This is the general mode of proceeding in the tæniada; and it will consequently be seen how the cystica, which were formerly regarded as a distinct class, are nothing more than one phase in the life-cycle of the tæniada. The only apparent exception, as yet observed, to the rule, that for the exclusion of the active embryo the ovum containing it must pass through the stomach of an animal, is that of bothriocephalus latus, in which it would appear that the embryos are capable of living in water after escaping from the ovum in the form of a ciliated infusorium or planula; and it is a curious circumstance that in this species the egg-shell is furnished with a sort of movable lid, to facilitate the escape of the embryo.

The various forms of cyst-worms have received the generic names of cysticercus, cænurus, echinococcus, and anthocephalus; and it is with the tæniada in this phase only that we have here much concern, the tape-worms themselves coming more properly under the notice of the physician.

The following species of tæniada are enumerated by Dr. Cobbold* as having been met with in the human subject; some are perhaps apocryphal. Opposite the name of each tape-worm or "strobila" we have given (when known) that of its cystic representative.

1. Tænia solium	Cysticercus cellulosæ.
2. " mediocanellata	" t. medio-canellatæ.
3. " acanthotrias	
4. " flavopuncta	
5. " marginata	" tenuicollis.
6. " echinococcus	Echinococcus, acephalocyst, &c.
7. " nana (Siebold)	
8. " elliptica	
9. Bothriocephalus latus	
10. " cordatus	

The cystic scolex of the common tape-worm is the cysticercus cellulosæ of authors. The most usual habitat of this species is the muscular tissue of the pig, which when thus affected is said to be "measly." It is frequently met with, however, in other situations and in other animals, especially in man.

* *Proceed. Zool. Society*, 1862, p. 289.

It is distinguished by its quadrangular head, short neck, thickened anteriorly, its long cylindrical body, and elliptical caudal vesicle, which, when the worm is lodged in the muscles, has its long diameter in the direction of the fibres. Nothing very positive is known respecting the earliest stages of the development of the "six-hooked embryo," as it does not appear by any means quite certain that the peculiar elongated cysts in muscle first noticed by Hessling, and afterwards more fully described by Mr. Rainey,* have any actual relation to this cysticercus.

In the earliest stage at which it has been positively made out the worm is about 1 millimètre in length, and nearly spherical in shape. It is formed at this time simply of a minute vesicle, whose walls exhibit a distinct and rich plexus of vessels, within the smaller branches of which vibratile tags are visible, whilst the interior of the vesicle is filled with a clear fluid. On one part of the wall the rudiment of the head or future scolex may be seen as a small opaque spot. The development of this part gradually proceeds, until at length it attains its full size, and projects into the interior of the enlarged cyst, invaginated, as it were, in a sac formed from the internal layer of the cyst. At first the "head" is straight; but as it increases in size it becomes bent at nearly a right angle, and eventually at its lower or inner extremity the characteristic acetabula and hooks of the tænia make their appearance. The entire course of development up to the completion of the cysticercal condition appears to require between two and three months. How long the parasite may remain in this stage within the tissues of its host is unknown, though it would appear from the observations of Stich† not to exceed a few years at most.

Though comparatively rare among ourselves, it seems that in some countries the occurrence of cysticercus cellulosæ as a human parasite is by no means uncommon. This difference it is not easy to account for, unless, with Leuckart, we admit the possibility of self-infection from the ova of the tape-worm, and consequently that a difference in habits of cleanliness or care may be followed by corresponding consequences. It is not improbable, however, that a greater frequency of occurrence of cysticerci in the pig in any country will lead to a greater frequency of occurrence of the tape-worm in man; and the more especially so, when, as is the case in many parts of Germany, large quantities of pig's-flesh in an almost uncooked or raw state are consumed. As a proof of the frequency of cysticercus cellulosæ in certain districts, we may observe that Rudolphi states that in his experience it was met with in about one body in fifty-six of those brought into the dissecting-room at Berlin; and it would seem that in many parts of Germany scarcely a year passes in any anatomical school without instances of its occurrence. These instances, however, have for the most part only been discovered after death; the presence of the parasite when lodged in the muscular tissue being apparently unattended with any symptoms except in rare cases.

The comparative frequency of cysticercus in the different organs or tissues may be stated in the following order:

The muscular tissue, or rather perhaps the inter-muscular connective tissue; the brain and eye; heart; lungs; liver; and more rarely the kidney and lymphatic glands. The spleen, and even the osseous tissue, according to Stich, are not exempt from its invasion; though with respect to the latter situation at any rate considerable doubts may reasonably be entertained. It may be observed, also, that in cases where the cysticerci are found in the muscular tissues, they usually exist in vast numbers; whilst in cases where they occupy other situations, they are usually few in number, or even solitary. In the human subject it has been suggested by Leuckart‡ that where the parasite has been found in considerable numbers, it has been in cases of what

* *Phil. Trans.* 1857, p. 111.

† *Annal. d. Charité Krankenhäuses*, 1854, p. 170.

‡ *Mensch. Parasit.* p. 281.

may be termed self-infection by the passage of a tape-worm or of a proglottis, or it may be of some ova alone into the stomach. The not infrequent concurrence of cysticerci in the tissues with tape-worms in the intestine affords, as he remarks, a strong proof of this. Von Gräfe relates that of thirteen individuals treated by him for cysticerci in the eye, five were also infested with tape-worm. The fact, at any rate, points to the necessity of care in persons so affected not to infect themselves with the mature ova either externally or internally. For it is not improbable that the "hexacanthus" may be liberated from the ovum by mechanical violence as well as by the solvent action of the gastric juice; and when thus liberated, may be capable of making its way as easily through the membranes of the eyeball as of the intestine.

With respect to the symptoms produced by *cysticercus cellulosæ*, it has been already said that when confined, as is most usual, to the muscular or subcutaneous connective tissues, the parasite appears to be wholly innocuous. The power even of the affected muscles is not notably impaired; and this is the case, it would seem, with the heart as elsewhere. Nor do the adventitious cysts in which the worm is lodged seem to be liable to spontaneous inflammation, though instances are recorded of their becoming inflamed and suppurating in consequence of pressure or external injury in exposed situations; as on the extremities, nates, &c.

It is far otherwise, however, when the entozoon has penetrated into the eye or brain. Passing over, here, the symptoms arising from its presence in the latter situation, we will refer more particularly to the morbid phenomena produced by it in the organ of vision. For our knowledge of this subject we are chiefly indebted to Professor von Gräfe, who seems to have enjoyed abundant opportunities of studying it. His papers will be found principally in the *Archiv für Ophthalmologie* for 1857. In the eye the *cysticercus* presents itself in two different conditions, free and encysted. The former occurs only in the aqueous chamber or in the crystalline body, or rather its capsule; and it is considered probable that these free embryos have escaped into those situations from cysts originally lodged in the coats, and especially in the iris or choroid. Occasionally, however, when in the crystalline lens the vermicule becomes surrounded with a secondary cyst. The changes and injurious effects produced vary, of course, according to the situation occupied by the *cysticercus*. In the subconjunctival connective tissue its presence is rarely manifested by any symptom beyond occasional slight conjunctivitis. But when lodged in the aqueous chamber the consequences are more important; for not only does it directly hinder the free passage of the rays of light, but the irritation caused by it is often accompanied with a chronic inflammation of the surrounding membranes. But its effects when in the deeper parts of the organ are still more serious. Here it may be lodged, enclosed in a capsule, either beneath the retina or in the vitreous humour. It is probable that it always makes its way through the retina to reach the latter situation. The presence of the parasite on or near the retina and choroid induces chronic inflammation and disorganisation of those important parts, eventually leading even to total blindness.

The objective signs of the presence of a *cysticercus* in the eye are extremely obscure without the aid of the ophthalmoscope. But with the aid of that instrument the parasite may be detected in the bottom of the eye, where it appears in the form of a light-coloured or semi-transparent vesicular swelling, whose position with relation to the retina may, in some cases, be determined by the appearance of the capillary vessels. When the cyst is covered in front by the retina, the vessels of that coat will be seen coursing over the little swelling; but when it is lodged in the vitreous humour or on the inner surface of the retina, the vessels will be seen to terminate suddenly as they pass behind the tumour. The prognosis, in most cases, will be more favourable in the latter case than in the former.

2. *T. echinococcus*. Another and far more familiar tænioid entozoon is

that of which the acephalocyst and echinococcus represent the cystic and scolecid conditions. The *tænia* or strobila of this species is at present known to occur only in the dog and wolf. It is of small size, and usually exists to the number of many thousands among the villi of the small intestine, where the *tæniæ* are rendered apparent by the white colour of the mature proglottides.

The ordinary form in which this entozoon occurs in the human subject is that of a semi-transparent globose vesicle, with highly-elastic laminated walls, lined with a finely-granular layer, and which is lodged, sometimes in great numbers together, in the parenchyma of the liver, lungs, or other solid viscera, or in the connective tissue in almost any part of the body, and enclosed in a distinct capsule formed by exudation into and the consolidation of the surrounding tissue. The interior of these cysts is filled with a clear watery fluid, in which may sometimes, but by no means always, be seen floating a few or many *tænia* heads, or scolices, the so-termed echinococci. Sometimes, however, the only remains of these will be the minute hooklets with which they are armed. But though usually met with in this detached condition, these heads in the recent and perfect state of the cyst will be found adherent to its inner wall or granular layer, to which they appear to be attached by a short peduncle. When so attached, they are seen through the transparent walls of the acephalocyst as minute opaque or whitish specks. It more often happens, however, and as it would seem especially in the human subject, that numerous acephalocysts may be examined without the discovery of a single echinococcus head.

Hydatid cysts are capable of multiplying themselves in another way; and it is to this property that their destructive power is mainly due. Although an individual cyst may singly attain to enormous dimensions, it is more from their rapid and continued propagation that the large hydatid tumours, and consequent great mischief caused by them, are produced. This multiplication takes place by what may be termed a sort of gemmation or proliferation in the walls of the cyst; and it is effected in two or three different ways. The secondary cysts arise in the substance of the walls of the parent hydatid; and when they have reached a certain size become detached, and are then capable of independent growth and of again themselves throwing off similar buds; and so on *ad infinitum*. The secondary cysts may be protruded and thrown off either on the exterior or into the interior of the parent vesicle. In the former case, we have the exogenous form of hydatid, or the *E. scolecipariens* of Küchenmeister; and in the latter is produced the well-known endogenous or "pill-box" hydatid of authors. Both forms occur in the human subject, though the latter by far the more frequently; and they may both even be found in the same subject. In either case the multiplication is sometimes carried to an enormous extent, and yet in the whole number of hydatids not a single echinococcus will be found. Professor Leuckart mentions a case of a woman about sixty years of age who had a tumour for many years, which was supposed to arise from an extra-uterine foetation; but on examination after death was found to be caused by a colossal acephalocyst springing originally from the liver, but which had gradually filled the abdomen with a sac weighing with its contents about thirty pounds. In its interior were many thousands of secondary cysts, from the size of a pea to that of the fist; but not a single head or hooklet was any where discernible.

Acephalocysts with several hundreds of secondary cysts are not uncommon; but usually the number of the latter is under a hundred, and generally perhaps from twenty-five to fifty.

A third modification in the mode of development, or rather of multiplication of hydatids, has been described under the name of *E. multilocularis*. In this form the cysts never attain to any thing like the dimensions of the two former, rarely exceeding those of a millet-seed, or at most of a pea. But though of these small dimensions, the cyst is capable of producing compound growths of considerable size, and consisting of aggregations of vesicles imbedded in a

common stroma. When a mass of this kind is cut across, it presents in the interior innumerable minute cavities of irregular form, separated by condensed connective tissue, and containing a tolerably transparent gelatinous material. Running amongst them may be seen the atrophied remains of the bile-ducts or blood-vessels, &c. Growths of this kind have hitherto been observed only in the liver; but as there appears to be no reason why they should not occur elsewhere, it may be useful to advert a little further to them. The alveolar structure and the gelatiniform nature of the contents of the cysts naturally led observers at first to suppose that they constituted a form of colloid cancer, the occasional presence of echinococcus heads or hooklets being deemed a merely accidental complication. Virchow,* however, has clearly pointed out the correspondence between these so-termed colloid masses and minute echinococcus-cysts. His observations have since been amply confirmed by Professor Leuckart,† who has fully satisfied himself that all the cysts, down to the smallest, present the well-known characters of the common acephalocysts. He, moreover, ascertained that the echinococcus-heads contained in them were identical with those found in the usual hydatids, and that the multiplication of the cysts followed the type of *E. altricipariens*.

The connexion between the hydatid cysts and the *tænia*, from which they are derived, hardly requires to be here pointed out, after what has been said on the general mode of development of the *tæniada*. The strobila in the intestine of the dog throws off proglottides containing the mature ova, which, on passing into the stomach of another animal, liberate the enclosed embryo, which makes its way through the walls of the intestine, penetrating either directly into the contiguous connective tissue, or finding their way into the blood-vessels, by which they may be conveyed through the branches of the portal system into the liver, or through other channels into all parts of the body. Hydatids consequently, even to a far greater extent than cysticerci, may be found in any part and in any of the tissues, including the bones themselves. In some respects, however, the two forms of cystic worms seem to affect different tissues by preference. The most common seat of the cysticercus is, as has been said, the muscular system—a situation in which acephalocysts rarely occur. The eye and brain, also, are more rarely invaded by acephalocysts than by cysticerci. By far the most common situation for hydatids in the human subject is the liver. In other situations, out of about 200 cases, Professor Leuckart states that in about 40 the lungs were the seat of invasion; in 30, the muscular and subcutaneous connective tissue; in 30, the kidneys; in 26, the lower pelvis; in 20, the nervous centres; in 17, the bones; and in 10, the heart. The remaining 17 were distributed among the orbit, eyeball, mouth, thyroid body, walls of uterus, &c. In general, in man, hydatids are confined to a single locality, though this is by no means always the case.

The frequency of occurrence of hydatids appears to vary much in different parts of the world. In this country, and in Europe generally, they are but rarely met with; whilst in Iceland it would seem that one-fifth or one-sixth of the entire population are affected. In any case the poor appear to be more often affected than the rich; a circumstance easily explicable by their different habits.

The growth of hydatid tumours, when, from their external situation or from other circumstances, their existence is early manifested, appears to be extremely slow. Thus Velpeau removed a hydatid tumour from the axilla, which in six months had only reached the size of a walnut; and, in another case, the tumour had reached the size of the fist in about a twelvemonth. The endogenous or “pill-box” hydatid is probably slower of growth than the other varieties, although in process of time it may acquire far greater dimensions. The ill effects of a hydatid growth vary, of course, according to its site. The more important situations in which tumours of this kind present

* *Das alveolar Colloid der Leber*, Tübingen, 1854.

† *Op. cit.* p. 373.

themselves to the Surgeon's notice are in the liver, eye, bones, and in external situations in any part of the body. A not unfrequent situation, also, is the lower pelvis, where by its growth the tumour may so far impede the functions of the bladder, uterus, or rectum, as to call for operative interference. The diagnosis, however, of such cases is extremely difficult, as similar symptoms may, as is obvious, arise from tumours of almost any kind in the same situation. The distinction, perhaps, might be drawn more from collateral circumstances or negative proofs than from any positive symptoms. When developed in the interior of a bone, the signs of a hydatid growth would be equally obscure until the tumour had reached considerable dimensions, and an exploratory opening had perhaps been made.

When it occurs in the eye, the effects of an acephalocyst would be much the same as those produced by a cysticercus, except that as the growth of the latter is far more rapid, the ill consequences of the parasite are slower of development in the one case than in the other. The distinction during life, however, would be extremely difficult and of no practical importance.

Although the duration of hydatid tumours is generally very prolonged, in fact lasting for the whole of life, it not unfrequently happens that they die, as it were, at an early period, and either cause suppuration, and are thus discharged, or become cretified and wholly innocuous.

The best treatment of a hydatid tumour appears to be that of making a free opening into it, so as to give exit to the contents and an opening to any subsequent discharge. In cases of hydatid tumour of the liver, it has been proposed, and the proposal has been occasionally carried out with success, to make the incision at two intervals in cases where there was reason to suppose that no adhesion existed between the wall of the abdomen and the coverings of the cyst. But in the majority of cases it will, perhaps, be better to wait until there is fair reason to conclude that adhesion has been set up. The injection of the cysts with various solutions, as of iodine, perchloride of iron, nitrate of silver, &c. has been practised; and some have thought with good effect. As the wall of the cavity containing the acephalocysts is in some respects analogous to those of a chronic abscess, the closure of the cavity when emptied will take place in the same way as in the case of an abscess.

None of the other species of tæniada infesting man require any observation here.

Trematoda. The trematoda, in many respects allied to the tæniada, differ from them in the possession of a distinct alimentary canal, with a mouth, but without any anal opening. They are also always solitary, and never associated into compound growths. They are for the most part hermaphrodite, though in some cases the sexes appear to be distinct. As in the tæniada, the vitellus is furnished by a distinct vitellarium. In the course of their development, the trematoda, like the tæniada, present several phases, and require for its completion to migrate from one animal to another. Unlike the tæniada, however, with the probable exception of bothriocephalus, the larval forms of the trematoda are enabled to live, probably for a long time, and to enjoy active powers of locomotion, external to the body of an animal, into which also they are capable, in many cases, of making their way through the external integuments. They thus form, as it were, a link between the parasitic and non-parasitic scolecids, having relations on one side with the turbellaria, and on the other with the tæniada. The course of development of a trematode may be thus briefly described: from the ovum generated in the mature fluke is produced a ciliated embryo or planula, which, after remaining in the water for some time, is converted into an elongated vermiform creature, sometimes termed a "redia," which, in some cases, possesses a tolerably well-developed alimentary tube and a distinct opening for the exclusion of the young; whilst in others it is reduced to a simple elongated tube, with no visible trace of internal organisation, and immobile. Within these rediæ or cercaria-sacs are produced, by a sort of internal gemmation, numerous minute tadpole-like creatures (cercariæ), which, when liberated, swim actively about until they

meet with a suitable "host," into which they bore their way, casting off the now useless caudal appendage.

Although some such cycle as this has been clearly traced in several species of trematoda, nothing of the kind has as yet been ascertained with respect to those infesting the human frame. It is only from analogy that these have been supposed to undergo similar changes. Whether the sheep, in which the liver-fluke is so extremely frequent, become infected by swallowing with the grass they feed upon snails into which the cercariform larvæ of a distoma had entered, or whether they receive the cercariæ in the water they drink, as is perhaps more likely, has not as yet been made out. Nor is there any thing further known as to the mode in which flukes enter the human body.

About nine species of trematode entozoa are recorded as occurring in the human subject:*

1. *Fasciola hepatica*, Linn. (*Distoma hepaticum*, Aut.)
2. *Distoma lanceolatum*, Mehlis.
3. " *crassum*, Busk.
4. " *ophthalmobium*, Diesing.
5. " *heterophyes*, Von Siebold.
6. *Bilharzia hæmatobia*, Cobbold.
7. *Tetrastoma renale*, Delle Chiaje.
8. *Hexathyridium pingüicola*, Treutler.
9. " *venarum*, Treutler.

Fortunately, however, most of this formidable list are of very rare occurrence, and the majority have been met with only once or twice. One or two only among them offer any points of interest to the Surgeon.

Fasciola hepatica. The common liver-fluke of the sheep has been met with in the human body less rarely perhaps than any of the rest; but even of its occurrence not more than nine or ten cases are recorded. It was found in the gall-bladder by Mr. Partridge; and in the liver itself, or more probably in the biliary ducts, by Bidloo, Wepfer, Pallas, Brera, and Mehlis; in the duodenum, by Brera; and several together in the portal vein and its branches, by M. Duval. Three apparently well-proved cases of the occurrence of the liver-fluke in subcutaneous abscesses have been recorded. Of these one, related by Giesker and Frey,† was in the sole of the foot; another, related by ourselves,‡ occurred in the practice of Mr. Charles Fox of Topsham in Devonshire. In this case a living fasciola was extracted by that Surgeon himself from an abscess behind the right ear. A third case is related by M. Dionis des Carrières,§ of one extracted from a tumour in the right hypochondrium. The swelling was about the size of a pigeon's-egg, and excessively painful, hard, and at first deep-seated. A fourth instance of the same kind, but perhaps not so thoroughly authenticated in all respects, though we ourselves see no reason to doubt it, was communicated to Prof. Owen by Dr. J. Penn Harris of Liverpool.|| In this instance several flukes were said to have been found in an abscess under the scalp. One peculiarity in all these cases consisted in the tendency the abscesses showed, after they had been opened, to close and become refilled.

Distoma ophthalmobium, Diesing (*Monostoma lentis*, Nordmann). In the eyes of several species of fish a peculiar trematode parasite, termed *diplostomum volvens*, was discovered by Von Nordmann, and has been excellently described and figured by him.¶ Prof. Jüngken** extracted a lens in a state of incipient cataract, in which he found eight minute trematoda, which were

* Dr. Cobbold, *Proc. Zool. Soc.* 1862.

† *Mittheilungen der Naturforschender Gesellschaft in Zürich*, 1850, ii. p. 89.

‡ Küchenmeister, *Manual of Parasites* (Sydenham Society's translation), vol. i.

Appendix, p. 434.

§ Davaine, *Traité des Entozoaires*, p. 320.

|| Küchenmeister, *op. cit.* Appendix, p. 435.

¶ *Mikrographische Beiträge*, p. 28, pl. i. figs. 1-3.

** Küchenmeister, *Manual*, &c. vol. i. p. 245.

referred by Von Nordmann to the genus *monostomum*. And Gescheidt* found in the eyes of a child five months old, affected with congenital cataract, between the lens and its capsule, four specimens of a distoma $\frac{1}{4}$ to $\frac{1}{2}$ a line in length, some of which exhibited signs of vitality thirty-six hours after the death of the child. Dr. Cobbold considers that "all these circumstances render it probable that the worms extracted by Professor Jüngken were specifically identical with those removed by Gescheidt."

What relation these trematoda have to that of the fishes' eye, or what their origin and life-history may be, is at present wholly unknown.

Bilharzia hæmatobia. This minute piliform species, which is not more than 3 to 4 lines in length, is distinguished among its congeners by its being bisexual. It appears to be extraordinarily abundant in Egypt, having been noticed by Griesinger 117 times in 363 bodies. Its primary habitat seems to be in the portal-venous system, and it is especially common in the minute veins in the walls of the urinary bladder. Its presence in the latter situation is indicated after death by circumscribed patches of inflamed and thickened mucous membrane, and by tenacious viscous grayish-yellow exudations, in which the ova of the entozoa are lodged. The ova are also sometimes found free in the urine, and thus afford a ready means of diagnosis. The vascular spots are sometimes raised into pedunculate excrescences 1 to 3 lines high, and having a fungous or verrucose appearance. The inroads of the worm are, however, not always limited to the bladder, but may extend to the ureters, or even as far as the pelvis of the kidney itself. When the ureters are affected, the thickening of the submucous tissue may produce such a constriction of the canal as to cause retention of urine above it, and thus to lead to dilatation of the pelvis, and ultimately to disorganisation of the gland. The aggregations of ova not unfrequently also constitute the nuclei of calculous deposits; and this appears to be the nature of the lithiasis of the Egyptians described by Prosper Alpinus.†

(b) *Nematelmia*. The nematelmia, or round worms, although, from certain points in their organisation, and more particularly with respect to the circulatory and nervous systems, very distinct from the annelida proper, nevertheless approach that class far nearer than do the platyelmia, than which they are much more highly organised. The body, which is always elongated and cylindrical, does not consist of a solid parenchyma with the viscera simply imbedded in it; but contains within a distinct integument a true perivisceral cavity, in which the alimentary and reproductive organs float freely. Within the integument also, and closely attached to it, are usually longitudinal muscular bands, which enable the animal to perform various and active movements. In most of the nematelmia also the alimentary and reproductive systems exhibit a considerable advance. The former consists in all cases of a distinct tube, usually subdivided into a pharynx or œsophagus, stomach, and intestines, and in most furnished with a mouth and anus, though in some few instances, as in the gordiacea, the latter may be wanting. The mouth is sometimes armed with hooks, or other horny parts; sometimes quite simple. As regards the reproductive system, the sexes are always distinct, although the male and female organs are for the most part formed on the same common type. In both sexes the reproductive organ is represented by a long slender tube, in which in the female may be distinguished an ovary, Fallopian tube, uterus, vagina, and vulva; corresponding to which in the male we find a testicular portion, a vas deferens, a sort of vesicula seminalis, and ejaculatory portion or duct, and in many cases an intromittent organ or penis. In the male the genital tube appears invariably to open at the hinder extremity of the body; whilst in the female the vulva may be in almost any part, and is very often to be found about the middle of its length. Impreg-

* Ammon, *Zeitsch. f. Ophthalmol.* iii. No. 4.

† Küchenmeister, *Manual*, &c. vol. i. p. 285.

nation is internal, and many species are viviparous. In one case only (*trichina*) does any thing like migration from one animal to another appear to be necessary for the development of the species. In some instances the male and female are alike in size and form; but in most they differ considerably in both respects, the male being sometimes immeasurably smaller than the female.

Numerous entozoa belonging to this sub-class have been mentioned as occurring in the human subject, of which the following is a list:

1. *Ascaris lumbricoides*, Linn.
2. „ *mystax*, Rudolph.
3. *Trichocephalus dispar*, Rudolph.
4. *Trichina spiralis*, Owen.
5. *Filaria medinensis*, Gmelin.
6. „ *lentis*, Diesing.
7. „ *bronchialis*, Rudolph.
8. *Strongylus gigas*, Diesing.
9. *Sclerostoma duodenale*, Von Siebold.
10. *Oxyuris vermicularis*, Bremser.
- ? 11. *Spiroptera hominis*, Rudolph.
- ? 12. *Dactylius aculeatus*, Curling.

In this long list, however, not more than three or four demand any notice here, the remainder being for the most part exclusively intestinal parasites. We shall notice only

1. *Trichina spiralis*.
2. *Filaria medinensis*.
3. „ *lentis*.
4. *Oxyuris vermicularis*.

Trichina spiralis. Although, strictly speaking, this worm is scarcely likely to become the object of surgical treatment, yet as it may not unfrequently come under the Surgeon's notice in the course of operations, and appears also occasionally to be productive of local symptoms, or to require exploration by surgical means for its detection, it may not be wholly out of place to take some notice of it. This curious parasite was first described by Mr. Hilton in 1832; and about the same time other cases were observed by Mr. Wormald and Mr. Paget. Portions of the affected muscles having been sent to Prof. Owen, the principal characters of the entozoon were made known by him. Numerous cases have since been published both in this country and abroad, and the subject has attracted the attention of many observers. Küchenmeister supposed that it might be the young state of *trichocephalus dispar*, and we were ourselves at one time disposed to adopt this view; but later researches have fully shown that the two are perfectly distinct.

The entozoon may be regarded as peculiar to the voluntary muscular system. The muscles affected with it are seen on section, or even without, to be studded with innumerable minute yellowish-white specks, of an elliptical form, the long diameter corresponding with the direction of the fibres. Each of these specks on examination will be found to contain a minute vesicle, in which is a coiled-up vermicule about one millimètre in length when stretched out. The cysts themselves vary somewhat in size, and are about one-third of a millimètre long. The cyst appears to belong to the worm itself, and not to be the product of any exudation in the surrounding tissue. *Trichinæ*, however, may exist in the unencysted condition in the flesh of animals without being visible to the naked eye, and even the cysts, before cretification has commenced, may easily escape detection without the aid of a lens.

It has been pretty satisfactorily proved that the chief source of the introduction of *trichinæ* into the human system is by the eating of trichinous pork, and more particularly so if the meat is raw or badly cooked. Even if in the form of sausages or hams—unless these have been long made and well smoked—the flesh of the pig when trichinised appears to be capable of communicating the germs. The vermicules are exceedingly tenacious of life, and retain their vitality even in decomposed meat, and after long immersion

in water, or even in glycerine; and the cysts are so constituted as to be unaffected by moderately strong acids.

One of the most remarkable features of trichinæ is the rapidity of their development. A very few days after the ingestion of trichinised meat the vermicules exhibit sexual distinction and maturity, rapidly produce their ova, from which while still within the parent the embryos are liberated, and commence active migration on their own account. This they effect by perforating the walls of the intestine and making their way to the voluntary muscles, where they become encysted, and thus complete the cycle of their existence. The whole process is apparently concluded within a single month, or even less. The genesis and migrations of trichinæ are therefore astonishingly rapid, and it is no wonder that the sudden invasion of such a host of foes should occasionally give rise to grave disturbance in the system.

The invasion is often attended with a singular febrile affection, presenting most of the characters of acute rheumatic fever, from which it is mainly distinguished by the absence of any articular affection. Local swellings of the muscles, especially of the calves of the legs, have been observed; and in doubtful cases an exploratory puncture and the abstraction of a minute portion of the muscle will serve to settle the diagnosis.

Filaria medinensis. The well-known dracunculus, or guinea-worm, is perhaps the most important, in a surgical point of view at any rate, of all the human entozoa. Although the greater part of the world is, happily, exempt, except occasionally, from its attack; in those regions in which it is endemic the guinea-worm may justly be regarded as one of the most pernicious pests to which mankind is exposed. Fortunately it appears, strictly speaking, to be indigenous in only a comparatively limited portion of the north tropical and subtropical zones; its geographical centre of diffusion being the continent of Africa south of the Great Desert, and north, as it would seem, of the equator. From this centre, however, it spreads more or less extensively into the contiguous parts of Africa, and to the opposite portion of Asia, extending as far north as the borders of the Caspian and into Central Asia, though how far to the east is uncertain. It is common in many parts of the Indian Peninsula, but more especially towards the west. The abundance of its occurrence in countries beyond the continent of Africa would seem, in fact, to bear some proportion to the amount of their direct communication with the Negro races. For the same reason it has become established in some of the West-India Islands, and especially, it is said, in the island of Curaçoa; and also on the continent in Demerara, and other parts of the mainland of tropical America. But although a certain geographical range may thus be assigned to *filaria medinensis*, it is nevertheless met with occasionally in all parts of the globe, and in individuals of every race; the only condition apparently necessary being that they should have visited some of the parts comprised in its endemic range within a certain period. It is consequently not unfrequently brought under the notice of the Surgeon in this country and elsewhere; and as the effects produced by it are sometimes very grave, the subject of the guinea-worm is one of some importance to him.

Not to enter at too great length into the natural history of the worm, it may suffice to remark that from what is known of it there is every reason to conclude that the parasitic condition represents but one phase of an existence, some portion of which must be passed external to the human or any animal body. This circumstance leads to the consideration of the relations of the guinea-worm to other allied forms. Here we are at once struck with the close resemblance in many respects between its habits and those of several species of gordiacea, or hair-worms, which at one period of their existence are found in the interior of insects or other animals, or even of grain. Several species of gordius, mermis, &c., are known, whose ova are deposited in water or moist earth; the embryos produced from which make their way into the bodies of aquatic or other insects, or of water-fowl, and there

become developed into worms, often of considerable size. In the case also of the anguillula of wheat, the larva, according to Davaine,^{*} is known to exist for several months in water, and also to be able to endure complete desiccation for even several years without perishing. From these, therefore,—and many more similar cases might be cited,—we see that there is nothing unusual in the conditions we have presumed to obtain in that of the guinea-worm.

One important conclusion, in a practical point of view, to be drawn from this observation is, that the guinea-worm cannot propagate itself directly in the tissues of its "host." *It is absolutely necessary for its multiplication that it should pass through some stage of existence external to the body.* And as this stage of existence may be supposed to demand certain conditions met with only in certain regions, but with which we are not at present fully acquainted, an apparent reason is thence afforded for its limited geographical range.

Some have supposed that there may be more than one species of guinea-worm, and Dr. McClelland† even thinks there may be many kinds in India alone. But at present, in our opinion, none of the reasons adduced in support of this notion are sufficient to sustain it.

In its parasitic stage the guinea-worm, when it has arrived at maturity—that is to say, when it contains active embryos of the full size—varies in length from about two feet or less to six feet, or even more, if we are to believe some accounts. It appears to be usually shorter, or to arrive sooner at maturity perhaps, in Bombay than is observed in this country in the case of worms contracted on the coast of Africa. In the former locality the length appears to be about three feet; whilst from the latter, so far as our own observation extends, it is seldom less than six. It is cylindrical in form, and nearly white when quite fresh. The surface is smooth, although under a magnifying-glass it is seen to be marked with fine irregular circular rugæ. It is very tough and elastic, to which property, perhaps, more than to any muscular contraction, is due the retraction of the worm when suddenly broken off. In structure it may briefly be described as an elongated tube, open at one end only, and whose walls are constituted by an external integument, strengthened by four longitudinal muscular bands; whilst the interior is lined by the enormously dilated uterus, whose wall is scarcely distinguishable from the common parietes; between the two, however, runs a slender and inconspicuous intestinal tube. The mouth is a simple minute circular pore; and there is no anus. The internal cavity consequently represents the interior of what, were the animal sexual, would be the uterus. As it is, it is more properly comparable with the "redia" of a trematode, seeing that it produces, by a sort of gemmation, as it would seem, innumerable embryos, which are usually found in an active state in the midst of a grumous or pulsatous substance, and in all stages of development. The full-sized young are about the forty-second part of an inch in length, fusiform in shape, and tapering off rather suddenly into a slender elongated caudal portion. Internally they present traces of an intestine, which terminates, according to some, in an anus at about the junction of the middle and hinder thirds. Vestiges of other organs may also be discerned, to which it is needless here to refer. These minute creatures, when first extracted from the maternal body, are very active and vivacious when placed in warm water; they are also extremely tenacious of life, being capable, as shown by experiment, not only of living for many days in damp earth, but of enduring complete desiccation for a considerable time. The mouth of the young filariæ is merely a simple pore, and they have apparently no organs fitted for boring into animal tissues. The great similarity between these young guinea-worms and certain microscopic filaridæ, and especially one species among them named by Dr. H. C. Carter *urolabes palustris*,‡ has in-

* Recherches sur l'Anguillule du Blé niellé, in *Mém. d. l. Soc. Biol.* 1856.

† *Calcutta Journal of Nat. History*, vol. i. 1841.

‡ *Annals and Mag. Nat. Hist.* 1859, vol. iv. p. 32.

duced that excellent observer to consider it highly probable that they are identical. The species in question abounds in the mud of tanks and ponds about Bombay; and Dr. Carter relates many circumstances in support of his belief, that it is by the entrance through the integument of these minute filariæ that the guinea-worm effects its lodgment in the body. He further thinks that the young filariæ enter through a sudoriferous duct, or a hair-follicle. Observation, however, has yet to show the true relation between these unarmed aquatic filariæ and the entozoon. In our view of the case probability would seem to be in favour of the notion that the filariæ in question do not themselves represent the future parasite; but that the active embryos of the latter, finding their way into the water or mud, develop sexual organs and produce ova, the embryos proceeding from which may or may not have a filariform aspect, and may or may not be furnished with some boring apparatus, but which, as in the case of mermis and gordius, enter the human body and become the guinea-worm, which would thus correspond to a "nurse" or "redia," as before remarked, and as was suggested by ourselves in 1845.* The male guinea-worm is at present quite unknown, and it will probably be found under a distinct guise from that of the female. It may be, and probably is, infinitely more minute than its mate, upon which it may even be parasitic, as in the remarkable case of the gordiaceus entozoon of the humble-bee, *sphærolaria bombi*, described by Mr. Lubbock.†

The above brief account of the natural history of the guinea-worm will serve merely to give an idea of the direction in which prophylactic measures are likely to be successful. Whether Dr. Carter's supposition be exactly correct or not, it is abundantly proved that the infection of guinea-worm is conveyed directly from without, through the integuments in the neighbourhood of the parts in which it is found lodged. The notion entertained by some that it may be introduced through drinking water seems to us to be devoid of all evidence or probability in its support.

Symptoms and effects of guinea-worm. The entrance of the worm into the body, however effected, is unattended with any observable symptom; and even when fairly lodged and growing rapidly in the tissues, the person affected is wholly unconscious of its existence until the period when it is ready to make its exit, or rather to discharge the cargo of embryos with which it is crammed.

The life of the worm as a parasite may consequently be divided into two periods, in one of which it is latent, and in the other manifests its presence by external signs.

The latent period would seem to vary considerably in duration, if we can rely upon all the reported cases; but in our own experience, which has been considerable, of cases as they occur in this country, this period is from ten to eighteen months, seldom less or more, and usually about twelve. During this period the worm resides in the cellular tissue, and probably in most cases at some depth from the surface; but this of course will vary according to the part invaded. In one case in which a guinea-worm fully six feet long was accidentally discovered lodged in the deep cellular tissue of the leg around the tendo Achillis, and which occurred under our own observation, no morbid symptom whatever was exhibited during life, nor after death was there the slightest appearance of irritation in the surrounding tissue.

When arrived at maturity, the worm makes its presence and the place of its intended appearance known by various symptoms, such as itching, slight swelling, usually circumscribed, but sometimes diffuse, and which gradually assumes the aspect of an inflamed pustule or boil. These symptoms are, in some cases, attended with considerable constitutional disturbance, and with severe lancinating deep-seated pains; but this is by no means always the

* *Microscopical Transact.* vol. ii. p. 80.

† *Linn. Transact.* vol. xxiv. p. 101, pl. 21, 22.

case. When left to itself, the worm invariably presents itself head first. On this account, unless an opportunity (which rarely occurs) be afforded of seeing the case before the pustule be opened, the head is usually destroyed. The after progress of the case depends very much upon, 1st, the general state of health or habit of the individual; and 2dly, on the mode in which the extraction is conducted. The latter proceeding is usually effected by winding the protruded portion of the worm round a piece of wood, quill, or bougie, day by day, so long each time as it yields to gentle traction. The animal is tolerably tough and highly elastic, as before said, and will consequently bear a considerable amount of stretching without risk; but for the same reason, should the force employed be too great, the worm when broken is immediately withdrawn to a great depth. This event is usually followed by considerable deep-seated inflammation and suppuration, which is liable to be succeeded by extensive sinuses and sloughing of the cellular tissue, requiring long and deep incisions. In these cases there is reason to believe that the remainder of the worm has perished, and that the wide-spreading irritation is due to its presence as a dead and decomposing foreign body. In other cases, however, when the worm retracts in the same way, but in which it does not so perish, the original orifice may close up with little or no signs of irritation of the deeper tissues, and after a time the entozoon will show itself at another distant part of the surface in the same way as at first. In India it would seem that the more experienced native practitioners are skilful in cutting down upon the worm when near the surface, and are thus enabled to seize it by the middle, and to effect its extraction very speedily. It sometimes happens also that the entire worm may be coiled up close to the point of exit, and may thus be removed *en bloc*; but it is far more usual to find that the extraction is a long and tedious proceeding, demanding great care on the part of the Surgeon, and considerable patience and fortitude on that of the patient.

Filaria lentis. Cases are recited of the occurrence of minute filariform worms in the orbit and within the eyeball itself. Some of these, and especially those in the former situation, may not improbably be instances of immature guinea-worms; whilst those met with in the interior of the globe would seem to belong to a different species altogether. Very few cases, however, of this kind are recorded. In three of these the minute filaria was seated in the crystalline lens, or rather perhaps between the lens and its capsule; and in one its habitation was the anterior chamber. To this minute worm, about whose structure and natural history we have no further information, the name of *filaria lentis*, or *oculi*, has been applied. It may perhaps turn out to belong to the genus *trichina*.

Oxyuris vermicularis. The common thread-worm, though properly an inhabitant of the lower bowel only, may occasionally come under the cognisance of the Surgeon when it has found its way into the female vagina, or wandered into loose mucous folds external to the anus, where, as in a case mentioned by Cruveilhier, and cited by M. Davaine,* it may give rise to considerable annoyance. Another circumstance also connected with the presence of thread-worms is the sympathetic irritation sometimes produced by them upon the sexual organs, leading, according to Lallemand,† to frequent seminal emissions and other grave consequences.

Doubtful and false nematoid entozoa. Among these may be enumerated:

1. *Strongylus gigas*.
2. *Spiroptera hominis*.
3. *Dactylius aculeatus*.

Strongylus gigas. In the kidney and urinary passages of several animals, both carnivorous and herbivorous, but more especially the former, such as the dog, wolf, jackal, polecat, ox, horse, and otter, and more rarely in the ab-

* Op. cit. p. 211.

† *Des Pertes seminales involontaires*, t. iii.

dominal cavity, a large-sized nematoid worm, distinguished by certain characters from ascaris and oxyuris, has been often observed. In dogs it is known to produce various symptoms of urinary disorder. Several cases of a nematoid worm in the same situations in man are recorded by authors; but these accounts are all either of such remote date, or so imperfect, that it is impossible from them to conclude whether the worm in question be really identical with that of the animals above mentioned, or another species of the same genus, or whether, as is not improbable, in all the human cases some confusion has not arisen with the common round worm, *ascaris lumbricoides*.

Spiroptera hominis. The only case of the occurrence of this supposed entozoon is that related by Mr. Lawrence* of a woman in St. Sepulchre's Workhouse, who was said to pass worms from the urethra; and they were occasionally even drawn-off through the catheter; so that no doubt as to any deception was at the time entertained.

Recent examination, however, by Dr. Schneider† of the specimens which had been forwarded to Rudolphi, and are still preserved in his collection at Berlin, has shown that the grossest deception must have been practised by the patient. The objects were contained in three bottles. In the first they turned out to be specimens of the common filaria (*agamonema*) *piscium*; in the second, which contained what Rudolphi terms "concrementa lymphatica," they were apparently fine shreds of some intestine; and in the third bottle were the ova of some fish. It was the latter that were said to have been brought away through the catheter. *Spiroptera hominis*, therefore, must be removed from the list of entozoa.

Dactylius aculeatus. The vermiform creature described under this name by Mr. Curling,‡ as having been passed in the urine of a female child of five years old, from the figure and description obviously belongs to the chaetopodous worms, and has no claim whatever to be ranked among the entozoic nematoids.

III. *Arachnida*. The only forms belonging to the arachnida that can properly be regarded as human parasites, although many others may occasionally attack him, are,

1. *Acarus* (demodex) *folliculorum*.
2. *Sarcoptes* (acarus) *scabiei*.

Both of these, however, are more properly to be considered under cutaneous diseases or eruptions, and will therefore be passed over in this place.

IV. *Insecta*. The same, with one exception, may be said of the parasitic insecta, of which we will content ourselves with giving a list only:

- | | |
|-------------------------------|----------------------------|
| 1. <i>Pediculus capitis</i> . | 4. <i>Pulex irritans</i> . |
| 2. " <i>vestimenti</i> . | 5. " <i>penetrans</i> . |
| 3. <i>Phthirius pubis</i> . | |

We shall concern ourselves here only with the last.

Pulex penetrans, the sand-flea (chigoe, chigger, or jigger), is considerably smaller than the common flea, and has a proboscis as long as the body. The male, and also the female until impregnated, lives solely in sand, and does not attack man; but the impregnated female is one of the worst pests in the West Indies, and in many parts of South America. Humboldt states that it only attacks Europeans, and not the aborigines; but there is no doubt that it is as much attracted by the Negro as by the white man. The impregnated female introduces itself beneath the nails or between the toes and other parts of the naked foot, and soon enlarges into a white globular vesicle about the size of a pea, by the rapid growth of the ova or rather larvæ, which are formed

* *Med.-Chir. Transact.* vol. ii. p. 385.

† Müller's *Archiv*, 1862, p. 275.

‡ *Med.-Chir. Trans.* vol. xxii. pp. 274 and 282.

and contained in a membranous bag beneath the abdomen. The presence of this rapidly-growing intruder causes considerable irritation and annoyance, and if the distended orifice be incautiously ruptured, the escape of the numerous progeny into the surrounding tissues is often followed by suppuration and tedious ulceration. The treatment, which requires some skill and sharp eyesight, consists in dilating the orifice through which the insect has entered with a needle, and carefully extracting it whole.

VEGETABLE PARASITES.

A considerable number of vegetable parasitic growths have been enumerated as infesting man as well as many other animals, and affecting both the external surface of the body and some of the internal mucous passages which are exposed to the air. These growths belong, for the most part, to the fungi, and, with perhaps one or two exceptions, amongst which the fungus peculiar to favus should, in our opinion, undoubtedly be included, the rest, in all probability, are merely different forms of the common mould (*mucor mucedo*), or of other minute fungi of a common kind. At any rate, as they all, or nearly all, are closely connected with certain cutaneous affections which have been treated of elsewhere, it will be needless here to say any thing concerning them. It is far otherwise, however, with a particular form of fungus, which appears to constitute the essence of a very serious surgical disease in the East.

In the *Transactions of the Medical and Physical Society of Bombay*, No. vi. for 1861, p. 104, will be found an elaborate paper by Dr. H. Vandyke Carter, concerning a "New and striking form of Fungus-Disease principally affecting the foot, and prevailing endemically in many parts of India."

Though the true nature of this extraordinary affection is for the first time explained in this valuable paper, the affection itself appears to have long been noticed by Indian Surgeons as one of a peculiar kind. It was distinguished in the medical reports under the name of "ulcus grave," "morbus tuberculosus pedis," "Madura-foot," "peculiar tubercular disease," &c. The disease appears to be of not unfrequent occurrence in the Bombay and Madras presidencies, and since its nature has been made known, cases of it have been met with also in Bengal. It appears, therefore, to pervade most of the hotter parts of the Indian Peninsula. It attacks men far oftener than women, and is almost exclusively confined to the feet.

Dr. Carter distinguishes at least two varieties of the affection; and the account he gives of a case* will serve very well to give an idea of the appearances produced by it. The subject was a Hindoo farmer, aged about thirty-five years, residing near Poona in the Deccan. When admitted into hospital on September 21st, 1859, his right foot was much enlarged, particularly about the ankle; the general form of the swelling was oval, somewhat resembling that of extensive scrofulous caries of the part; the skin was thrown into coarse corrugated wrinkles. On either side of the ankle-joint and on the dorsum of the foot, near the toes, and also in the sole, were numerous small soft swellings or tubercles as large as a pea or marble, having puckered apertures or fistulous openings; and at these points the skin appeared lighter in colour than elsewhere. The tubercles were in all stages, from a slight elevation of the surface to an acuminated point, and there a puckered fistulous orifice appeared. A probe introduced into one of these openings entered a long but not tortuous sinus, many of which led to bare bone. A discoloured glairy sero-purulent fluid exuded on pressure, frequently mixed with a few black gritty particles. The toes were distorted and displaced upwards, and the muscles of the calf were atrophied. The disease was of twelve years' standing, and the history given was this: when wading in a nullah or water-course, a thorn stuck in the sole of the foot, bleeding followed, and an abscess

* Loc. cit. p. 111.

formed the size of a walnut. The swelling began to spread, without much pain, from the sole of the foot and toes towards the ankle. Amputation was performed, and the patient made a complete recovery.

On section of the parts after removal, the disease was at once seen to be characterised by the presence of numerous black masses, studded throughout both hard and soft parts. There was no deposit in the cancelli of the bones, and no blending of the parts, as observed in cancer; and the black masses could be picked out quite clean from the cavity or space in which they were contained, and which was lined with a membrane. There was no appearance of caries, the osseous tissue having been removed apparently wholly by absorption. Nor was there any alteration or thickening of the soft parts, such as occurs in elephantiasis, &c.

In the second variety, although the external appearances are not unlike, a considerable difference exists in the absence of the black masses. The bones are affected nevertheless in a similar way, and a fungus is also to be found. In a case recorded* of this variety, the "diseased parts consisted of collections of what looked like sloughing tissue; gray or blackish masses, almost glairy in consistence and accumulated in loculi, from which they could be readily drawn out, whether in the soft parts or in the bones, which were excavated to receive them. No black granules were seen, and only after a careful examination were white granules detected in the interior of the loculi."

The discharge from the sinuses was examined, prior to the amputation, by the microscope: it presented, together with blood-corpuscles and granule-cells, numerous small bodies barely visible as white dots to the naked eye; but when magnified, appearing rounded and tuberculated, of a yellowish tint, and slightly varying in size. These were the fungi.

In some cases where the disease is still more advanced, the destruction and obliteration of parts is still greater; till at last scarcely any remains of the original tissues either hard or soft are recognisable. The general characters of the affection are thus summed up by Dr. Carter:

1. *External appearances.* Globular, or flattened form of swelling, often very considerable; never extending above the foot. Skin first studded with blebs or soft tubercles, marked with numerous sinuous apertures. A thin discharge, often scanty and watery, and generally containing small granules or particles, either barely visible or distinct, soft, and like poppy-seeds, or black in colour.

2. *Appearances on dissection.* General confusion of parts, owing to absorption of the bones, and fibrous thickening of the soft parts. Often the presence of granules, separate or aggregated into mulberry-like masses of a yellow or brown colour; lodged in spherical cavities excavated in the bones or soft parts, or in tunnels or channels leading from the cavities to the openings on the surface, and also lined with a membrane.

Sometimes there is a deposit of a fleshy substance, containing numerous minute particles (white or red), and occupying the same localities as the above-mentioned granular deposit. Lastly, in the same cavities and tunnels may be found black granules, spheroidal tuberculated masses of the same colour, and radiated in structure.

Dr. Carter adduces many considerations to show that this curious parasitic fungus is introduced from without, and draws a close comparison between the mode of its invasion and reproduction with that of the guinea-worm, which is highly interesting, but too long for notice here.

Masses of the truffle-like fungoid tubera having been furnished to Mr. Berkeley, that eminent fungologist has procured from them the mycelium and fructification, and has thus determined the botanical characters and systematic position of the fungus, to which he has given the name of *chionyphe Carteri*.†

* Loc. cit. p. 115.

† *Intellectual Observer*, vol. ii. p. 248.

Amputation of the affected part appears to be always successful in putting a stop to the extension of the mischief.

G. BUSK.

VENOMOUS INSECTS AND REPTILES.

UNDER this head is included the consideration of wounds inflicted by animals, into which some poisonous or irritating material is introduced. In this country and in many others the subject is one of little importance; but in some, more especially in the warmer regions of the globe, it demands the serious attention of the Surgeon. But from the great general similarity, except as regards degree of severity, in the effects produced by wounds of this kind, and as their treatment is to be guided by obvious and simple principles, there is neither room nor need for any extended observations on the medical or surgical aspect of the question. But we have thought that some space might be usefully occupied in pointing out the different classes of animals amongst which venomous species are found, and in indicating those species more especially whose attacks are most to be dreaded.

A. INVERTEBRATA.

Poisoned wounds inflicted by insects and arachnida. In this section might be enumerated a considerable number of species whose bites or stings are attended with a greater or less degree of irritation and inflammation; but from the trifling nature of the injuries inflicted by most of them, it is unnecessary here to notice any but those whose attacks are attended with what may be termed serious effects.

Considered in this regard, the most formidable of the venomous invertebrate animals belong to the classes arachnida and myriapoda. Under the former are included the scorpion, of whose venomous properties there is no doubt, and several spiders, whose evil reputation rests perhaps upon less certain grounds. The only myriapod that can positively be said to possess any venomous power is a species of scolopendra (*S. morsitans*).

(a) *The scorpion* (*S. europæus*, *S. occitanus*, &c.). The scorpions (scorpionidæ) are characterised by their elongated jointed caudiform abdomen, which is armed at its extremity with a hooked claw. This claw, which is perforated and connected at the base with poison-glands, constitutes the *sting*. In the larger species, inhabiting the hotter regions of the globe, the effects of the scorpion's sting in man appear to be very serious, if not in some cases actually fatal; and even in the smaller species found in the south of Europe its effects are very unpleasant, and not altogether unattended with danger to delicate or irritable individuals. The symptoms produced by it very much resemble those produced by the stings of bees and wasps in an aggravated degree: such as acute pain, a general nervous shock attended with numbness, vertigo, occasionally temporary loss of sight, vomiting, &c.; whilst the local symptoms are swelling and other signs of acute inflammation, followed in many cases by suppuration, sloughing, and their consequences.

The remedy which appears to have obtained the greatest repute, and to be recommended by the most trustworthy evidence, is the application of ammonia externally, and its internal administration as a stimulant also; although it is probable that any other diffusible stimulus combined with opiates would be equally, if not more, efficacious. A variety of plants, belonging more especially to the cruciferae, have also been supposed to possess useful properties in the treatment of the effects of the scorpion's sting.

(b) *Centipedes* (scolopendridæ). Several species of scolopendra enjoy the reputation of being highly venomous; and there is, perhaps, no doubt that

the bite of some of the larger kinds, and especially of *S. morsitans*, a large species inhabiting the hotter regions of the globe, has occasionally been attended with very troublesome and painful consequences. The poison of these creatures is conveyed not by a caudal sting, as in the scorpions, but by somewhat similarly formed curved fangs connected with the mandibles, which are perforated, and probably communicate with special poison-glands, although the existence of such organs does not appear as yet to have been satisfactorily made out. The bite of the centipede, though described as excessively painful, does not seem to be usually followed by the same severe symptoms as is the sting of the scorpion; and it is not improbable, therefore, that no poison is actually introduced.

(c) *Spiders (araneida)*. The bite of several species of spiders is said by various writers to be venomous; but the testimony, speaking generally, upon which this property is attributed to them does not appear to be very conclusive.

Spiders have from time immemorial enjoyed the evil reputation of being highly poisonous when swallowed, and very powerful medicinal properties have even been assigned to their webs. These notions, however,—no doubt due to the disgust felt by most persons at the sight of such ugly creatures,—are of course totally unfounded; nor, perhaps, with one or two more or less problematical exceptions, does there seem to be any better reason for believing that their bite inflicts more than a simple wound.

One or two species, however, deserve more particular notice.

The first of these, the tarantula or tarentula (*lycosa tarentula*), a large spider belonging to the tribe of citigrade, or running spiders, and which abounds in Southern Europe, and more especially in South Italy, has long acquired an extraordinary, but as it would seem wholly undeserved, infamous reputation. The concurrent testimony of all competent observers has conclusively shown that the extraordinary stories of the affections produced by the bite of the tarantula, and of the no less extraordinary methods of cure adopted, are the records either of wilful deception or of the strange pranks the imagination may play in the apparent production and removal of morbid symptoms. Direct experiments in various hands show that the bite of this spider is unattended with any ill effect beyond slight local irritation.

Another spider, belonging to an entirely different tribe, but which is also found in the south of Europe, is said to produce a similar train of symptoms to those attributed to the tarantula, and doubtless having the same origin.

A third species (*aranea 13-guttata*) is also reputed to inflict a very dangerous and even fatal bite both upon men and domestic animals in the island of Elba; and in Morocco a spider, there called the *tendaraman*, has had equally formidable venomous powers attributed to it. It is said to be common in the cork-forests; and that its bite is so poisonous that the persons bitten by it survive but a few hours. But we may surely be allowed to doubt all such stories; especially when we learn that the spider always makes towards the head in order to inflict its deadly wound.

(d) *Venomous insects*. A great variety of insects appear to have the power of inflicting wounds attended with a greater or less amount of local irritation. But whether in the majority of these cases any poison is actually introduced into the punctures made by their lancet-like proboscis appears to be by no means certain. It is highly probable that the effect, as is often the case with leech-bites, is due to prolonged mechanical irritation only. It must be confessed, nevertheless, that in other cases the severe pain which attends the bites of very minute creatures can scarcely be accounted for, except on the supposition that they are accompanied with the introduction of some irritating, if not actually venomous, material; as of formic acid, for instance, in the case of ants; or perhaps of an acrid salivary secretion in other insects.

In some cases, however, it would seem that certain insects are capable of

affording a truly poisonous matter of a septic and diffusive nature, by which, independently even of any local irritation, the whole system may be fatally affected. The most remarkable case of this kind is that of the dipterous fly termed "tsetse" (*glossina morsitans*), of whose ravages, or supposed ravages, we have so graphic though unsatisfactory an account in Dr. Livingstone's travels. It is true that this fly is innocuous to man; but, nevertheless, its alleged effects upon certain animals are so extraordinary, and it might almost be said so incredible, as fully to deserve some notice in this place. The tsetse is a harmless-looking insect, very little larger than a house-fly; but its bite is said to be certain death to domestic cattle, the sheep, horse, and dog, whilst it is innocuous not only to man, but to the goat, antelope, ass, and pig, as well as to all wild-animals whatever, and even, what is strangest of all, to the calf so long as it is sucking. The symptoms attributed to the bite of the tsetse do not arise immediately, but after an interval sometimes of several weeks. They appear to commence with a general disorder, attended with weakness and wasting, running at the nose and eyes, and glandular swellings under the jaw. The animals so affected invariably waste away and perish. The affection is said to be quite different from the "leg sickness," and other murrains, which are so common in South Africa; and to present this striking difference from them, that it is not contagious. A herd of healthy cattle is not infected by animals labouring under the effects of the tsetse-bite. Nor is an animal ever affected in the same way unless it has been into a district of country infested by the fly. These districts are described as being very distinctly defined, although separated from a healthy one sometimes only by a narrow river, or even by an imperceptible boundary. Nothing appears to have been ascertained with respect to the infested tracts of country being inhabited by any peculiar plant or vegetation; but, on the other hand, travellers seem to have convinced themselves that the tsetse-fly is never found except in districts inhabited by the elephant and rhinoceros; and that in proportion as those animals are destroyed, do the ravages of the fly diminish. It is much to be desired, however, that the subject should be further investigated.

Dr. Livingstone also mentions another insect, whose bite produces vomiting and purging in the human subject; but as he enters into no particulars we can merely notice the circumstance as one, if truly reported, of a very remarkable kind.

But although the bites of insects are comparatively so innocuous, it is otherwise with their stings. Stinging insects belong chiefly, if not exclusively, to the order hymenoptera, in which the sting, in the sterile females, represents the modified ovipositor. The instrument consists essentially of two exceedingly fine and sharp darts, enclosed in a tubular sheath, at the base of which is placed a special venom-gland or sac, whose contents are injected into the wound made by the usually serrated or barbed darts. The well-known consequences of the sting of the bee, wasp, and hornet, are too familiar to require particular notice. Though painful and annoying, except in cases of persons attacked by numerous swarms, these wounds can rarely be accounted serious, though the effects vary a good deal in different persons, and probably are more severe in warmer climates. When large communities of hymenoptera, however, are disturbed, and the assailant is attacked by great numbers of the angry members, very severe consequences, and even death itself, have often followed; and in one instance at least, the sting of a single insect (*mutilla coccinea*), a native of the warmer parts of North America, is said to produce loss of sense within five minutes after its infliction, and considerable apparent risk to life for several days afterwards.

Various remedies of a domestic nature are recommended to allay the smart and inflammation attending stings; amongst which vinegar, ammonia, flour, indigo in the form of the "blue-ball" of washerwomen, oil, spirit, eau-de-Cologne, &c., may be enumerated. Of these, ammonia in the form of sal volatile is perhaps as good as any.

B. VERTEBRATA.

Wounds inflicted by venomous snakes. Of a far more important character than those noticed in the preceding section are the poisoned wounds inflicted by animals belonging to the vertebrate sub-kingdom. Fortunately, as compared with the whole number of vertebrata, these are not very numerous, nor are they very powerful, except in the possession of their lethal weapons; and as they are for the most part slow of movement, and of a sluggish and retiring nature, they are not to man, at least in one sense, of any very great importance. The serious and often fatal nature of their attacks, however, render the subject of the wounds inflicted by them one of considerable interest and moment, especially in countries where the more powerful species are met with.

All the truly venomous vertebrata belong to the order of ophidian reptiles; to some few points with respect to the natural history and organisation of which, bearing upon the main subject of this section, we shall therefore now proceed to refer as briefly as possible.

Characteristics and classification of venomous reptiles. Many systematists have begun their classification of the ophidia by dividing them into the *innocua*, the *suspecta*, and the *venenosa*. But the exigencies of more recent zoological science demand a more exact classification than is afforded by such an artificial arrangement. Not to enter at any length into the principles upon which various schemes for their classification have been based, it will, for our present purpose—that of diagnosing venomous from non-venomous snakes—be sufficient to remark that the ophidia are very naturally subdivided into two large groups or sub-orders, clearly distinguished from each other by various particulars in their organisation. In one of these sub-orders all the species of which it is composed are more or less venomous; whilst in the other the majority are innocuous in that respect, though some are truly formidable in others.

The former group of true venomous snakes have been termed the *viperina*, or viperine snakes, of which the rattle-snake and viper are familiar examples; whilst the second have been denominated the *colubrina*, of which the common harmless ringed snake of this country is a specimen.

It will be useful briefly to state the chief characteristics of each sub-order.

Characters of the viperina. As has been remarked, all the members of this sub-order are venomous; any snake therefore exhibiting the following characters may at once be so regarded: The body is comparatively thick and clumsy; the general aspect sombre and lurid; and the usual movements sluggish and dull. The tail or part of the body behind the anus is thick and very short; the head broad, depressed, and triangular, or cordiform, joined to the trunk by a constricted neck, and covered on the summit not with plates or scutes, but with small scales, and having the integument usually loose and wrinkled; the eyes are small, wholly lateral, deeply lodged on the sides of the head, and shaded above by prominent over-hanging supra-ciliary rugose or tuberculated plates; the pupil is elongated and vertical; the upper lip descends on either side like that of the mastiff, so as to conceal the poison-fangs; the scales, lastly, are in almost every instance distinctly carinate or muricate. By these general external characters a viperine snake may usually be readily distinguished; but closer examination of the internal structure of the head and oral organs will disclose still more decisive characters. The chief points to be remarked here are the shortness and extreme mobility of the maxillary bones, each of which supports a single long-pointed and recurved tooth perforated throughout its entire length by a slender canal, and which is termed the poison-tooth or "fang." By a peculiar arrangement of the maxillary bones and muscles, this tooth when not in action can be reclined into a groove in the gum, where it is completely concealed, or it can be suddenly and forcibly erected when the animal is preparing to strike its deadly blow. The rest of the bones connected with the jaws, face, and gullet are in a corresponding manner very loosely articulated, and so disposed as to admit of enormous dilatation of the month and entrance into the pharynx. Besides

the fangs, the upper jaw contains no teeth, although a series of pointed recurved solid teeth occurs along the palate. In the lower jaw similar teeth are found at the extremity.

The fang, as has been said, is perforated by a slender canal, which opens above into a sort of sacculus surrounding the base of the tooth, into which opens a long curved duct leading from the poison-gland, which is a sacculated organ situated below and a little behind the orbit. This glandular sac has a thick aponeurotic wall, a great part of which is surrounded by muscular fibres connected with the temporal muscle, and which act as compressors of the gland and ejectors of its contents.

The *colubrine snakes*, among which are included the *hydrophidæ* or sea-snakes, differ in several important particulars from the *viperina*. In external form they are usually slenderer and more elongated, especially in the caudal region. The head is smaller or narrower in proportion, and in nearly every case continuous, as it were, with the body, and in all the more important members of the sub-order covered on the summit with large scutes or plates, usually nine in number; the scales, except in the sea-snakes, in which they are tuberculate, are smooth and non-carinate; the eyes are larger in proportion than in the *viperina*, and, except in one or two genera, have an orbicular pupil. To these general external characters may be added that their movements are more lively and active, and colours in most cases more brilliant and pleasing. Important differences also exist between the two groups in the structure and connexions of the cranial and facial bones, and especially in the dentition, in which their great distinction exists. Among these differences we may briefly notice the greater strength and compactness of articulation of the jaws and other bones connected with them, by which the oral cavity and gullet are rendered far less dilatable than they are in the *viperina*; and the greater length and size of the maxillary bones, which are furnished with numerous solid conical fixed teeth.

This great sub-order includes by far the largest number of snakes, varying in size from that of an earth-worm to the gigantic dimensions of the *boa-constrictor* and great *pythons*. Fortunately, few of these genera of snakes are venomous; but among those which are so, we find some of the most formidable of all. With the exception of the sea-snakes or *hydrophidæ*, all of which are reputed to be highly venomous, and which are at once distinguishable by their exclusively marine habitat, vertically flattened form, and fish-like habits, it is not easy to lay down in words any very accurate means of distinguishing the venomous from the non-venomous *colubrina*. They usually have the muzzle larger and blunter than the rest; the trunk more elongated, and the tail shorter, stunted, and conical; the eyes smaller, and in some cases with a vertical opening, although the pupil is always round; the nostrils wide and lateral, &c. But the more important species of this group, or those belonging to the genus *naja*, are characterised by the faculty they nearly all possess of expanding the sides of the neck when in an excited state, whence they are sometimes distinguished by the appellation of hooded snakes, or *cobras da capella*. The essential character, however, by which the venomous are distinguished from the non-venomous *colubrina*, is the development in the upper jaw of the former of one or more of the anterior maxillary teeth into poison-fangs. As we have said before, these teeth are always fixed or non-reclinable; and they differ also from the true poison-fangs of the *viperina* in not being perforated down the centre by a canal, but are adapted to the purpose of conveying poison into the wound by a groove on their anterior or convex side,—which is in connexion—much in the same way as the canal in the viperine fang—with a special poison-sac or gland; the chief difference being that the duct is short and straight, instead of long and curved, as in the latter case.*

* Certain snakes, as for instance those belonging to the genera *dipsas*, *dryophis*, and others, have the hindmost teeth in the upper jaw longer than the rest, and grooved or channelled, so as to bear some resemblance to poison-fangs. Many

Nature of the "venom," and its effects. Having thus briefly surveyed the general characteristics of venomous reptiles, we shall proceed to say a few words respecting the nature of the poisonous secretion itself, and to describe the effects which follow its introduction.

The venom of serpents is described, when fresh, as a transparent yellowish or greenish subviscous neutral fluid very much resembling saliva. In other sensible properties it is said to be insipid, and almost inodorous, and, in fact, to exhibit no obvious character denoting its virulent properties. It is heavier than water, and not very readily miscible with it; the mixture when shaken becoming turbid. According to Prince Lucien Bonaparte, it contains, besides albuminous or mucous and a small amount of fatty matter and the usual salts, a peculiar principle, to which he has given the name of "echidnine" or "viperine," but which appears, in most of its characters, strongly to resemble ptyaline. It is said, however, to possess active poisonous properties, which are retained even after it has been dried for a considerable time, if not exposed to the air. But, however simple in appearance and composition this fluid may be, it undoubtedly possesses the most energetic and remarkable physiological properties.

In the first place, it appears to be quite certain that the poison produces no effect, or scarcely any, beyond a temporary irritation of the passages, when introduced into the stomach; the only exception to this being some instances in which it would seem that pigeons were stupefied for a short time after being made to swallow it; at any rate its introduction in this way never seems to be followed by any very serious consequence. Nor does it produce any deleterious effect beyond, in some cases, a little local irritation, when applied to the surface of the skin, even when it has been slightly abraded. It would also appear, from Fontana's experiments, that it is innocuous when applied to an exposed surface of muscular tissue, to cartilage, the pericranium, periosteum, the dura mater, to the medullary cavity of bones, the cornea, tongue, lips, palate, &c. Applied to exposed nerves, it is equally inert; nor does it apparently affect the irritability of detached muscle. In fact, it may be said that the general result of experiment and observation tends to show that, in order to produce its specific effect, the poison must be introduced directly into the subcutaneous cellular tissue, though even here curious anomalies have been observed; amongst which is the circumstance that direct inoculation with the aid of a cutting instrument is less likely to succeed than when the poison is introduced through the fang itself. This, of course, may be owing to the greater outflow of blood in one case than in the other.

When properly introduced, however, its effects are very rapidly manifested; in fact, in some cases so rapidly, as more to resemble those of prussic-acid than any thing else; usually, however, a brief interval elapses before the effects are shown. These may be divided into general and local. The first symptom, in nearly all cases, appears to be a general shock to the nervous system, attended with faintness, tremor, and great depression—sometimes with stupor, loss of sight, vomiting, trismus, and general insensibility; at the same time great and sometimes intense local pain is set up. The limb, if the wound is in one of the extremities, rapidly swells; at first pale, the surface of the swelling soon becomes red and afterwards livid, and covered with phlyctenulæ filled with sanious fluid. In severe cases the swelling continues to spread through the whole limb, till it reaches the trunk or even the entire body, whose surface assumes a jaundiced hue. The symptoms, in fact, very closely resemble those of ordinary phlegmonous erysipelas, or diffuse inflammation of the subcutaneous cellular tissue. The constitutional symptoms,

writers have assigned a venomous character to them; but later observations, more especially of M. Schlegel, have conclusively shown that this is erroneous, and that the teeth in question have no poison-gland in connexion with them, but simply a gland in all respects resembling the salivary. This class of snakes has by some been denominated *suspecta*.

independently of the first shock, are what might be expected to accompany such a local affection, and in intensity are in proportion to its violence.

The gravity of the effects of the bite of a venomous snake appears to be in direct ratio to the comparative sizes of the snake and its victim, and also to the quantity of poisonous secretion present at the time in the saccular gland. It is also greatly governed by the situation of the wound; one on an extremity, for instance, being far less dangerous than on the face or trunk. It has been remarked also that two or more wounds at distant points are more rapidly effective than when they are inflicted in one spot, owing doubtless to the more rapid diffusion which takes place in the former case.

From a general survey of what is known, it would appear that the poison, in whatever principle it may reside, is one which acts primarily on the nervous system, and also as a septic poison on the tissues with which it is brought in contact; and that in order to produce its effects, it must be directly introduced into the circulation.

In the present state of our knowledge, it would be a waste of time to speculate upon the real nature of such poisonous, and, as it would seem, such apparently acrid, properties in a seemingly bland and harmless secretion. Its local effects might be regarded as due to its acting as a septic ferment, analogous to that by which many kinds of blood-poisoning are brought about; but if so, the "venom" would seem to differ from all such ferments with which we are acquainted in the circumstance that its effects vary in intensity directly with its quantity. The minutest possible portion of the variolous poison, or of the septic agent by which scarlatina and other analogous affections are produced, is as efficacious as a larger quantity; and the same may be said also of the septic poison introduced in a dissection-wound, of which the quantity introduced necessary to produce the same amount of local mischief is infinitely smaller than would be required in the case of the serpent's venom. That the effects of a septic ferment should be proportionate, except in a very remote and almost infinitesimal degree, with its quantity, is contrary apparently to all analogy; and at present, therefore, we are hardly justified in looking upon the venom of snakes simply as such a substance, notwithstanding that it possesses some of the properties incidental to it.

With respect to the treatment of "envenomed" wounds, all that is necessary will be found under the head "Poisoned Wounds," vol. i. p. 624.

G. BUSK.

SURGICAL DIAGNOSIS AND REGIONAL SURGERY.

DIAGNOSIS is the term used by Physicians and Surgeons to express the scientific opinion, or theory, which they form of each case presented to them in practice. The art of diagnosis may justly be said to be the main object of the study of medicine; as being the end to which all its theoretical parts converge, and the source from which all its practical rules proceed. The substances comprised in the *materia medica* are indeed innumerable, the varieties of surgical appliances and operations are infinite; and a competent knowledge of them is of course one of the fundamental requisites for a good practitioner. Still it is none the less true that the successful application of every one of those means depends upon a correct diagnosis of the morbid action which it is intended to subdue. Hence, a complete treatise on diagnosis is almost equivalent to a complete treatise on medicine; and to endeavour to write fully on surgical diagnosis in this place would be little less than to re-write the whole of the preceding work. But the student of the foregoing pages will, it is hoped, find there all that is necessary to guide him in the emergencies of

practice, as far as a book can assist him. The object of what follows is rather to point out the general principles on which surgical diagnosis is founded, and to endeavour to impress on the student the great importance of a full, and above all a methodical, plan of taking notes of cases. To no part of a Surgeon's duties is less attention given than to "taking cases;" and yet it is of great importance towards acquiring the power of correct diagnosis; a power which is the chief requisite for successful practice. Without in any respect undervaluing the triumphs of operative surgery,—in fact, while confessing that the successful performance of a great operation is the highest pleasure which the pursuit of surgery affords,—we may yet admit that many men of inferior powers have been bold, handy, and successful operators. But the attainment of great skill in diagnosis requires a combination of natural and acquired gifts, which are not within every one's reach; an amplitude of information not to be afforded by any single experience, and which therefore can only be got by extensive study of surgical literature; a familiarity with morbid symptoms and appearances, and a readiness in combining and interpreting them, which book-learning is quite unable to give, and which can be acquired only by long and careful study of disease at the bedside; and finally, and above all, a logical power of mind, which neither study nor experience can confer, but which must be born with its possessor.

In the few pages which are here at my disposal I can only hope to give a short exposition of the most elementary and universal principles of surgical diagnosis, with a few familiar illustrations of each topic, chiefly selected from the foregoing essays. I shall then proceed to illustrate the most important element of surgical diagnosis, viz. the anatomical examination of the diseased part, by some account of the more familiar surgical affections (chiefly tumours and abscesses), as they appear in the various main regions of the body.

All diagnosis, both medical and surgical, rests on three chief elements, viz. 1st, the history of the patient and of the disease previous to the time of examination; 2d, the symptoms of the disease at that time,—*i.e.* the functional disturbances which it has produced; 3d, the physical examination of the diseased part. These elements are common both to medicine and surgery; but while medical diagnosis relies mainly on the two former, and chiefly the second (except in diseases where auscultation plays the chief part), surgical diagnosis, on the contrary, is mainly concerned with the third, and hence its greater ease and greater certainty, since it deals more with matters cognisable by the senses. This, too, explains in some measure the great part which anatomy plays in scientific surgical education.

In order, therefore, to cultivate the art of diagnosis with success, the Surgeon must be accustomed to investigate the previous history of the patient and of his disease both fully and accurately; he must then collect together the symptoms, and compare them with those of the various known diseases to which they point; he must be thoroughly conversant with every kind of physical examination, and especially by the sense of touch; nor, after all, will he be a master of diagnosis unless he has sufficient reasoning powers to see all these particulars in their proper relative proportion, and sufficient caution and deliberation to weigh them sedulously against each other. We see mistakes in diagnosis committed daily—there are few of us who have not to look back with mortification on many of our own; but most men's experience will bear out the statement, that the great majority of them have been errors of *haste*, due in great measure to a pernicious habit, which the practice of our public institutions tends to create. There a great number of patients are to be attended to in so short a space of time, that it is physically impossible to go through the successive steps mentioned above, of inquiring into the history, the symptoms, and the appearances of each one as he presents himself; and the mind is too fatigued by the constant succession of varying phenomena to be able to follow out the reasoning process which is essential at the end of those successive steps. Hence we acquire the habit of leaping to a conclusion in the diagnosis of our own cases, and of acquiescing in the opinions of our

colleagues on theirs, without submitting to the labour of examining them methodically for ourselves. Such a habit is, I am persuaded, one of the worst results of our hospital system, and particularly of the out-patient department of it, through which all the officers of hospitals now pass at the beginning of their career. A man who is compelled to see a hundred patients in a couple of hours (and this is hardly an exaggeration of the pace at which the machine is driven) acquires the habit of judging of the case from the first glance, and judges usually with correctness. No doubt much rapidity and decision is obtained by this practice, and there are cases in surgery where these are the qualities chiefly required; but there are many others in which errors can only be avoided by great patience, and habits of this kind produce a character of mind to which patience is a stranger. Hence it is very desirable for students and young practitioners to practise the investigation of cases, whenever it is possible, upon a methodical plan, and to commit their notes of the cases to writing. This is of course unnecessary in many of the simpler surgical cases, but is almost indispensable in some of the obscurer ones, and is a useful corrective of the hasty practice which I have thought it my duty to reprehend. It would, however, be a grievous mistake to suppose that haste is the only danger to diagnosis; and accordingly, in dwelling on the main considerations relative to each of the three elements of surgical diagnosis, the main sources of error connected with them will also be touched upon.

I. *History.*

The first main source of diagnosis, viz. the history, comprises all the facts relating to the patient's ordinary circumstances, such as age, sex, and occupation, which are likely to throw light on the disease to be diagnosed; the circumstances under which the disease first showed itself, its alleged cause, the particulars of the first departure from health, the date at which the patient first sought medical advice, the nature and effect of the treatment adopted, and the progress of the malady up to the time of examination. These particulars are furnished by the patient himself; but they can in many cases be checked or corroborated by the records which the disease has left on the body, in the shape of the marks of old abscesses, the distortions produced by inflammation of muscles, the atrophy of disease, the results of old disease of joints, &c.

Let us consider these particulars somewhat more in detail.

Age. The patient's age is one of the most essential particulars in forming a diagnosis of the affection. That this is so at the extremes of life every one is aware. Thus, for instance, in the affections of the hip-joint. If it be an injury of the hip that is under examination, we know that intra-capsular fracture rarely occurs except at an advanced period of life, and never in youth; that dislocation is very rare in childhood; and that fracture of the cervix femoris within the capsule is a comparatively common effect of slight violence in old people of relaxed fibre. If it be a disease of the hip which is presented to us, we at once consider that in childhood the so-called strumous disease tending to, or depending on, chronic caries of the bones is exceedingly common, while acute abscess is rare; that in middle life the inflammatory affections which are excited by injury become more common; while at a more advanced period the main affection of the hip is that disease which was erroneously supposed to be peculiar to old age—chronic arthritis—the ‘*malum coxæ senile*’ of our older authors.

Amongst the numerous instances of the importance of paying attention to the age of the patient in forming the diagnosis, we may refer to the following examples taken from the previous pages of this work. In inflammatory affection of the cheek occurring in childhood, the presence or the imminence of that formidable affection called *cancrem oris* would be suspected, since this disease rarely occurs after ten or before one year of age (vol. i. p. 177); while in later life, rodent ulcer, lupus, and epithelioma, are the prevailing affections. In the examination of these latter forms of destructive ulceration, it must be

an important element in the diagnosis that rodent ulcers generally occur in the later half of life, and lupous in the earlier (vol. i. p. 210).

In affections suspected to be hysterical the period of life is of course of the utmost importance in diagnosis, since, though such affections occur to women at advanced periods of life, they are far more common in youth (vol. i. p. 366).

In injuries, if a distinction is to be drawn between dislocation and separation of the epiphysis, the period at which the latter point of bone is developed, and is joined to the shaft, must be steadily borne in mind (vol. i. p. 819); and in disease of the bones in childhood the same particular is of very great importance (vol. iii. p. 701).

These are a few of the many examples which might be cited of the importance of paying attention to the age of the patient in forming the diagnosis. But errors may easily be committed if more stress be laid on this particular than it deserves. Thus Sir A. Cooper first taught the now admitted fact that intra-capsular fracture of the femur is an injury peculiar to advanced age; and he very justly dwelt on this fact, and on the indisposition of the fracture to bony union, and consequently the impropriety of treatment directed to promote union by enforced rest in bed and confinement in splints. But in proceeding so far as to teach that nearly all fractures of the neck of the femur in old people are of this class, and therefore insusceptible of union, there is no doubt that he exaggerated the influence of age; since it is now demonstrated that most fractures of the neck of the bone, even at an advanced period of life, are partly extra-capsular (vol. ii. p. 596).

Sex. The importance of sex in the diagnosis of surgical affections is not limited to those of the genital organs and mamma. Other organs, such as the thyroid body, are notably modified in their affections by the influence of sex (vol. iv. p. 697); but besides this, the course and the character of all manner of diseases is different in males and females; and in the latter the strange sensibilities of the uterus lead to a train of symptoms most vaguely indicated by the term "hysterical;" a term which is the only one we can use, though it frequently conveys a very false impression of fiction or exaggeration in cases where the symptoms are as real as those which depend on organic disease, though they are not dangerous to life. Unless such sexual peculiarities were kept constantly in view, the daily-recurring, and quite innocent, painful affections of the limbs, the chest, the head, &c., would be constant sources of needless anxiety.

Errors in diagnosis, however, proceeding from too readily attributing the diseases of females to hysterical causes are so very common that the Surgeon must be constantly on his guard against them. This is so ordinary a matter of experience that it is needless to cite many instances. The mistake occurs chiefly in the early stages of deep-seated diseases of the bones; as in the case of a young woman, of hysterical temperament, admitted into St. George's Hospital for deep-seated pain about the pelvis. The disease, which was long treated as hysterical, then revealed its true nature by the formation of abscess; and death from caries of the sacro-iliac articulation ultimately ensued.

Occupation. The patient's occupation is sometimes, although not very often, a matter of primary importance. Thus in disease of the jaw, the fact of the patient being a worker in phosphorus would go a great way towards the establishment of the diagnosis. In diseases of the bursæ again, the patient being a tailor, a miner, a housemaid, would render the diagnosis more secure in case of a tumour situated over the fibula, the olecranon, the patella. Still more frequently the occupations connected with beer- or spirit-drinking (potmen, butlers, draymen, &c.), and those very laborious trades in which the habitual drinking of great quantities of beer is regarded as almost a matter of course (navigators, coalwhippers, &c.), furnish a very valuable indication for the diagnosis and prompt treatment of the early symptoms of delirium tremens, so apt to follow injuries in such persons (vol. i. p. 327). In some

rarer cases the patient has been exposed to the usual influences of particular trades, though his occupation is different; as in Earle's case of the gardener who contracted soot-cancer on his arm from his habit of carrying a bag of soot to use in his garden.

Social condition. The married or single condition should be noted both in men and women; and in the latter the number of pregnancies and of children, together with the causes, if known, of abortion. In the case of single persons it is often useful to know whether they are in the habit of illicit intercourse, and if so, whether such intercourse is promiscuous or not; and in all cases it is very desirable to be informed of any attacks of venereal disease, and its sequelæ.

Habits. This brings us to two still more important matters in the patient's history, viz. his habits and his previous diseases. The previous habits of the patient very often account in a great measure for the symptoms which he presents, being the indirect, even if they are not the direct, exciting cause of his disease. It is hardly necessary to do more than allude to the importance which known habits of prostitution would have on the diagnosis of disease (such as a skin-eruption) suspected to be syphilitic; of drunkenness, on that of restlessness, nervousness, and tendency to delusion; of masturbation, on that of peculiar nervous symptoms.* But besides these extreme and familiar instances, there are many others in which a candid confession on the part of the patient might assist the Surgeon's diagnosis most materially.

Closely connected also with the patient's habits of life is the character of his mind and his habit of body, both of which particulars often form important elements in the diagnosis, and materially assist the Surgeon in determining on the reality of pain, the exaggeration of accounts of previous disease, &c.

Previous diseases. The previous diseases must be carefully noted, since they often tend to throw light on the constitutional predisposition, and in the practice of surgery are perhaps of equal importance in accounting for local weakness and predisposition to disease. For an illustration of this we may refer to the diagnosis of cutaneous eruptions, or of affections of the bones, in which the history of a previous syphilitic affection, or of strumous disease in childhood, will often be a main point in the diagnosis. This head will include of course the constitutional peculiarities which the patient may manifest.

But in these three preceding particulars, perhaps more than all others, great care must be taken not to exalt what is, after all, a mere presumption into an absolute indication. Very many cases are wrongly diagnosed and treated, in consequence of forgetting the obvious truth that every disease occurring in an hysterical woman is not hysterical, nor every affection in a syphilitic patient syphilitic. Strumous children are not insusceptible of acute inflammatory affections, and these are often signally benefited by active treatment. Even in a cancerous patient we may meet with an innocent tumour, as is proved by the frequent occurrence in such persons of fibrous tumours of the uterus.

Hereditary tendencies. Closely allied to the previous diseases which the patient has himself suffered is the tendency to disease which he has inherited from his parents. In some cases this branch of the investigation is easy. Many families labour under hereditary tendencies to phthisis, cancer, or insanity, which are notorious, and are known to their friends as well as to themselves; but in many cases, and in diseases which are not so open to observation, it is otherwise. The most striking instance is congenital syphilis, in which not only is it extremely difficult to obtain evidence from the person who is really in fault, but in which the contagion may proceed from a person perfectly innocent; as, for instance, a perfectly chaste woman who has borne children to a syphilitic husband, and thus has contracted the constitutional disease, may bear syphilitic children to a second (sound) husband; or, to

* See a case by Mr. Hilton, in his Lectures on Rest and Pain, p. 268.

take a less extreme case, a healthy wet-nurse may be infected by her nursling and carry the disease into her own family, though both she and her husband may have been perfectly free from any known exposure to syphilis.

Of the great importance in diagnosis of the knowledge of the patient's constitutional tendencies, one of the most striking examples may be drawn from the essay on *ULCERS*, vol. i., throughout the whole of which this point is strongly dwelt on.

When all these preliminary subjects (which constitute the history of the patient) have been investigated, and duly noted, the examiner arrives at the history of the disease properly so called. This embraces the following main particulars: the alleged cause, the duration and onset of the disease, its course up to the time of examination, the nature and effect of the treatment which has been adopted, and some other miscellaneous circumstances.

The alleged cause. The knowledge of the cause of a disease is of primary importance for its diagnosis. Often, indeed, it is in itself sufficient to establish the diagnosis, as in the instance above cited of the phosphorus-disease, where the cause is the patient's occupation combined with caries of the teeth. But it is often one of the most difficult circumstances in the whole investigation to decide accurately. There is an almost invincible tendency to ascribe the disease to some accidental injury which the patient may have suffered, especially if that injury have acted only, or mainly, on the part affected; and it is often impossible to say whether this causal connexion is real or imaginary. Thus, to take a familiar instance, morbus coxarius in children is almost universally attributed by the mothers of the children to a blow, fall, or sprain, and by their medical attendants to the strumous diathesis, without which it is said that the local violence would have been harmless. Which party is most in the right? It is really very difficult to say; yet the point is very important to the diagnosis. If the disease be due to local violence in a child otherwise healthy, its character may be diagnosed as inflammatory, and local treatment may be expected to cure it; and so in the last resort, provided that so severe a measure be necessary, the excision of the whole of the diseased parts may often be expected to succeed; while if the affection be diagnosed as a constitutional one, the Surgeon could hope little from local measures. I have selected this instance in order to afford myself an opportunity to put on record my conviction that the diseased joints of children are too often set down hastily as "strumous," when in reality the affection is in no manner connected with the strumous constitutional taint.* It is very well known how frequently disease comes on, even after the lapse of a considerable time, in parts which have been the seat of injury (vol. i. p. 576); but it is extremely difficult to decide whether this is due to a real connexion, or is a mere coincidence.† But the difficulty of deciding as to the action of an injury is not unfrequently complicated by the doubt whether the injury has really occurred or no. For instance, how very often young female children are said by their parents to have contracted gonorrhœa from illegal intercourse, and how seldom is any thing of the sort proved. If every such story were credited by those who see much of infantile leucorrhœa, they would get into constant trouble and disgrace (vol. iv. p. 839). Besides such sources of deception, which rest upon honest mistakes (for the parents usually believe the disease to be so caused), the occasions for wilful deception are numerous. Many surgical diseases and injuries are caused by illegal or disgraceful acts, which the patient will not disclose,

* Mr. Bryant would repudiate the term "strumous disease" of a joint altogether (*Surg. Dis. of Children*, p. 123). This may be going a little too far; but the term has no doubt been much abused.

† It is well known that Sir B. Brodie's death was caused by malignant disease of the shoulder, and that the same shoulder had been the seat of dislocation some years before; but considering how often shoulders are dislocated, and how rarely any such disease follows, it is very difficult to believe that we have more in this instance than a casual coincidence.

whatever may be the hazard of concealing from the Surgeon the cause of his ailment (vol. iv. p. 873). Instances of such purposed concealment come too often under the notice of every Surgeon of experience, not to make them very cautious in receiving their patients' statements as to the alleged causes of disease; and therefore it is hardly necessary to quote instances of errors proceeding from a too ready acceptance of this part of the history. Perhaps one of the most fertile sources of these errors is the diagnosis of affections of the larynx in children, as to the presence or absence of a foreign body (vol. ii. p. 298).

Still, the cause of the affection plays a great part in surgical diagnosis; in fact, it sometimes forms the basis of our classification of disease. An instance of this is afforded by delirium tremens. There are other conditions of delirium which it is otherwise difficult to distinguish from the "delirium *è potu*," but which occur in persons known to be temperate. Nevertheless it is justly held advisable to classify these apart (that is to say, to diagnose them as independent diseases), and to restrict the term delirium tremens to the delirium of drunkards (vol. i. p. 328). The nature of many diseases was unknown till their exciting cause was discovered—a striking instance of which is afforded by glanders (vol. i. p. 639); in hydrophobia also the knowledge of the cause would materially facilitate the diagnosis of the early stage of the disease (vol. i. p. 629).

Inflammatory and other affections often are found to depend upon causes very far removed at first sight from their visible effects, but connected with them by nervous sympathies, which a knowledge of the anatomy and physiology of the nervous system can alone explain. In such cases the diagnosis is the more important, since on it depends the cure of the effect by the removal of the cause. This subject is illustrated by what is said at vol. i. p. 60, as to local inflammation excited by reflex or direct impressions on the nerves of the part inflamed, and by the instances quoted at vol. i. p. 174, of the effects of deprivation of nervous power in exposing the part to gangrene.

Duration. The duration of the disease is another point of the greatest importance in diagnosis, particularly with respect to the malignancy or innocence of tumours, to the inflammatory or chronic nature of diseases, and to a thousand such questions of everyday practice. In the diagnosis of the various forms of tumour in the groin and scrotum, the duration of the complaint up to the time when the tumour attained considerable dimensions is a point of extreme importance. The sudden formation of hernia, the gradual descent of psoas abscess, the slow growth of hydrocele, the rapid formation but slow increase of hæmatocele, the steady and rapid growth of malignant tumour of the testis, the slow increase and frequently the complete suspension in growth of varicocele,—are among the points connected with this part of the subject which have been dwelt on in the preceding pages.

Yet here again errors may easily be made. Thus some innocent tumours grow more rapidly than some cancers do; and in all tumours we must remember that the growth may have attained a large size before it has been noticed. Sometimes the growth of cancer is suspended during even a very considerable time (vol. i. p. 514). Again, in the course of a chronic affection, acute inflammation may occur; and the duration of the disease may be greatly influenced by the patient's time of life.

Course of disease. The course of the disease, from its onset up to the first visit of the patient, is of great importance, when it can be clearly traced; and so to a still greater degree is its course after the patient has come under treatment. There are not a few diseases of which no skill can enable the Surgeon to give a confident diagnosis without a knowledge of their course. Examples of this fact might be drawn from every part of surgery; perhaps one of the best is the mistake which long prevailed with respect to cases of partial displacement of the head of the humerus with adhesion of the remains of the long head of the biceps to the bicipital groove. These cases are now known to be due almost, if not quite, always to chronic rheumatic arthritis,

and not to rupture of the long tendon of the biceps from injury ; the diagnosis having been established mainly by the course of the disease (vol. iii. p. 725).

Effects of treatment. When the nature and effect of previous treatment can be accurately ascertained, a great auxiliary to diagnosis is often acquired ; in fact, in many cases the diagnosis can hardly be established without some such auxiliary. This is particularly the case in tumours of the testis, in which it is often impossible to tell whether the disease is malignant or simple chronic orchitis until the effect of a mercurial course has been noted (vol. iv. p. 598). So in tumours connected with bone. It is often impossible to say whether the swelling be a strumous, syphilitic, or rheumatic node, or a new growth, until the effect of appropriate local and constitutional treatment has been patiently watched. But here especial care must be taken to guard against errors which are so very liable to occur if the effect of treatment be judged of from the statements of the patient ; so that little importance can be attached to this particular in forming the diagnosis, unless the treatment has been watched by the Surgeon himself, or has been noted by another medical observer. Even then the temporary fluctuations occurring in all diseases are a fruitful source of error ; as in the instance cited above of a tumour of the testis, in which the diagnosis between cancer and chronic inflammation is to depend on the effects of a mercurial course. In malignant disease, temporary improvement of the patient's condition, and even some apparent diminution of the tumour, often follow on the rest in bed and other measures which are then for the first time adopted ; and thus the Surgeon is liable to be deceived into the belief that his treatment is acting upon an inflammatory disorder.

II. *Symptoms.*

The second of our general heads is that which comprises the symptoms presented by the patient at the time of examination. These symptoms are either those which the patient describes or those which he exhibits. Here the second of our general heads touches closely on the third ; for the examination of the patient's body discloses changes from the healthy condition which are in reality nothing but symptoms. In this place, however, it is intended to describe not the local lesions, but the general alterations from the natural state—the general physiognomy, as it were, of the disease. It is in the application of these general symptoms to the diagnosis of disease that the Surgeon has most need of an intimate acquaintance with physiology, since he has to connect all the functional disturbances which he discovers with the appropriate lesions of the organs presiding over those functions, and those again with their possible causes. It is difficult to arrange these symptoms in regular order, as we have done the particulars embraced under the title of "History." Unlike what occurs in medicine, almost every surgical disease has its local seat, and the few diseases which affect the whole body, as struma, constitutional syphilis, multiple or constitutional cancer, and erysipelas, are generally obvious. Thus surgical diagnosis, as far as it deals with the symptoms of disease, is chiefly concerned in obtaining a minute knowledge of the signs of each particular local ailment, and in separating them from each other. When the Surgeon has thus become accustomed to connect each disease with its own group of symptoms, he has to compare each group in his own mind with the account which the patient has given of his sufferings from the disease under examination. Here the difficulty is twofold. In the first place, as regards the groups of symptoms which we have been taught to associate with the name of each disease. These groups have been laid down in our books, as is done in the previous part of this work, with all the conscientious exactness which the subject demands. But we must remember that the names of diseases frequently do not represent natural objects created different from each other ; but are merely designations which have been affixed to sets of symptoms grouped together by nosologists. Now the infinite variety of nature easily eludes the bounds of our formal classification ; and we are constantly

meeting with groups of symptoms which can only be brought under one of these designations instead of another by a certain amount of violence, and which do in fact partake of the nature of both. Thus, to take an instance lying at the very threshold of our pathology—ulceration and gangrene in soft parts, or their equivalents caries and necrosis in bone, are names given to what are really parts of the same process, viz. the termination of inflammation in local death. The things are easy enough to distinguish from each other in extreme cases. When the bodies of several vertebræ have, as it were, melted away, without any visible portion of dead bone having ever been known to have exfoliated, there can be no hesitation in saying that here we have caries, not necrosis; when a limb drops off from the trunk black and rotten a few days after an injury, that this is gangrene, not ulceration. But in how many cases are the two processes mixed; how many receive different names from equally competent observers. Persons not in the medical profession, with whom the names of diseases naturally are held to represent real entities, are of course scandalised at such differences, and believe that they show either ignorance in the persons or imperfection in the art. They really show nothing except that scientific language cannot acquire the copiousness and variety of the natural processes. This difficulty, however, though it may lead to some confusion and some apparent difference of opinion in the intercourse of practitioners with each other, is not otherwise of much practical moment, since the indications of treatment depend less on accuracy in naming the disease than on sagacity in weighing its chief symptoms. The second is the more important of the two difficulties, viz. the difficulty in ascertaining from the patient what the symptoms really are. Patients who have acquired, as so very many have, a superficial knowledge of medical books, can easily describe the leading symptoms of cancer, uterine disease, stone, &c., which they either feel or imagine they feel. Besides, without the exercise of unusual caution it is very difficult for the Surgeon to avoid putting leading questions on a hypothesis hastily formed; and such questions are pretty sure to be answered in the way he desires. Thus great caution in weighing the patient's assertions, and comparing them with the indications to be drawn from his general condition and from the local appearances, is required in one who is to be a good investigator of symptoms; and with this should be conjoined much deliberation in forming any guess at the diagnosis before the evidence is complete, and much dexterity so to phrase the questions addressed to the patient as not to suggest to him in what way to answer them.

The least unsatisfactory way of arranging the symptoms appears to be in the order of the various organs whose functions such symptoms show to be disturbed. The table printed below (p. 944) will prove one of the most convenient methods of arrangement; and we shall devote in the sequel a few lines to some illustration of the groups of symptoms which are comprised in each of its headings, and of their practical importance in surgical diagnosis.

Nervous system. The first class of symptoms are those referred to the nervous system—the brain, spinal cord, and nerves. In our table these several parts of the nervous system have been separated from each other; and it is one of the main objects of the diagnostician to effect this separation; that is to say, to determine what symptoms point to the brain, what to the spinal cord, what to the nerves. To illustrate from one of the most common surgical symptoms, loss of motion following on injury. If the loss of motion affects one side of the body only, and is complicated with loss of consciousness, it is a clear indication of limited pressure on the brain. If no loss of consciousness is observed, it is only after the most searching investigation that we can admit that the loss of motion depends on lesion of the brain; yet if the palsy is strictly limited to one side of the body or to one set of nerves, this is the more likely hypothesis. If it affects both sides of the body, but not the intellect, or the facial muscles, or the functions of the nerves of special sense, the lesion must be in the spinal cord, at a level determined by the origin of

the nerves of the highest part to which the palsy extends. And we may observe that the more complete the palsy both of motion and sensation, the more extensive must be the pressure on, or disorganisation of, the cord. If, on the contrary, paralysis of the whole body is present with coma, the lesion must affect the brain, and that to a very great extent. If the loss of motion affects only a small part of the body, as a single limb, or a segment of a limb, or a still smaller part, it is clear that the nervous centres themselves are untouched; the lesion has either implicated one or more of the nerves; or else the loss of motion depends on injury to bones, joints, or muscles. The diagnosis depends in a great measure on whether the extent of the paralysis does or does not coincide with the anatomical distribution of the nerves.

Pain. In the table already referred to, pain, which is of all symptoms the most universal, has been placed under the head of 'nerves;' but this is only an arrangement dictated by convenience. The sense of pain, though always conveyed by the nerves, yet, as a diagnostic indication, comparatively very seldom points to the nervous system itself, but is usually indicative of a morbid state of the organs from which the nerves are derived. Want of space is alone a sufficient obstacle to our discussing the wide question of the value of pain as a symptom of disease.* Study of any section in the previous part of this work will show that almost every single affection has its peculiar kind and degree of pain. Such a study will also prove how much caution is required in estimating this complex and universal symptom; how easily inflammatory pain may be confounded with neuralgic or hysterical, and *vice versâ*. Again, the affections of many organs are signalised by pain in remote parts; as the pain in the knee, which is symptomatic of disease of the hip; the pain in the meatus urethræ, symptomatic of stone or ulceration of the bladder, or sometimes of disease of the kidneys; and generally the great number of instances in which pain referred to the extremity of a nerve is symptomatic of irritation at a higher part of its course.

Organs of sense. The symptoms referred to the organs of sense are those defects of sight, taste, smell, hearing, and touch, which are almost always present in all diseases, and which point either to organic lesions, functional disturbances, or affections of the nervous system, as the case may be. It would be endless to enumerate them. Let us take a prominent instance. If the student will turn to the essay on DISEASES OF THE EYE, vol. ii. p. 772, he will find an account of the numerous organic lesions of the deeper parts of the eye upon which loss of sight may depend; but loss of sight, even total loss, may be symptomatic merely of some affection of parts remote from the eye, as abscess of the antrum (vol. iv. p. 27); or may depend on some disease of the brain or the optic nerve (vol. ii. pp. 773, 785); or may be merely an effect of hæmorrhage, or of some depressing habit producing anæmia of the choroid or retina (vol. ii. p. 789). Most of these symptoms are obviously local, and their interpretation depends in a great measure upon the results of a physical examination of the organ.

Organs of respiration. The symptoms referred to the respiratory organs, though of less vital importance in surgical than in medical diagnosis, are yet numerous and highly important. We must be content here with one or two illustrations of the truth, that the broad facts, at any rate, if not the minutest phenomena, in this group of symptoms must be as present to the mind of the Surgeon, if he would succeed in diagnosis, as to that of the Physician; and it must not be forgotten that the diagnosis of surgical affections of the respiratory organs involves often that prompt action on which the instant saving or loss of life depends. Thus, in injuries of the neck, the importance of recognising the dyspnoea which may arise from fracture with displacement of the hyoid bone, and distinguishing it from the numerous other causes which may produce the same effect, is well illustrated by the case related at p. 898. Again,

* The reader may be referred to Mr. Hilton's Lectures on Rest and Pain.

in the same class of cases, how important is it to have studied minutely the symptoms produced by the impaction of a foreign body; to distinguish, for example, between the usually paroxysmal dyspnoea, with pain about the thyroid cartilage, but without fever or effusion in the air-passages, which are the leading symptoms of a foreign body impacted near the glottis, and the dyspnoea of croup (vol. ii. p. 300). It is true that the history, if it could be relied on, would make the diagnosis certain; but frequently in these cases the history is unknown or fallacious. To proceed with the same illustration, the reader may consult (vol. ii. p. 306) what has been said about the diagnosis between pneumonic consolidation causing absence of respiratory murmur, and the same phenomenon as the consequence of impaction of a foreign body in one of the main bronchial tubes. So too of the diagnosis between the various sources and kinds of effusion into the pleura after accident (vol. ii. pp. 360 et sqq.).

Organs of circulation. The condition of the organs of circulation is of very great importance in surgical diagnosis; not merely the general state of the pulse, which is always noted as a matter of course in all diseases, medical and surgical, but also the irregularities in the organs of local circulation, arterial, venous, and lymphatic. The various alterations in the arterial circulation caused by an aneurism furnish the most familiar example of the diagnostic signs drawn from the arteries; but there are innumerable others; among which we may instance the sudden loss of pulse in the lower part of a limb, traceable up to a definite point, after an injury, without great ecchymosis, diagnostic of rupture of the inner coats of an artery (vol. i. p. 672); the extraordinary enlargement of arteries, naturally imperceptible, which is observed in aneurism by anastomosis (vol. iii. p. 454); and the peculiar thrill noticed in the pulsation of the larger arteries in anæmic persons. In the venous circulation, some of the most common diagnostic phenomena are the passive enlargement of the veins of a part, with or without œdema, which marks simple obstruction at a higher point of the vessel, whether from coagulation of the blood, or pressure of a tumour; the hardness, redness, and tenderness along the vein, with œdema, which characterise phlebitis (vol. iii. p. 301); the purring thrill which is felt in large veins from pressure not completely interrupting the current. In the absorbent system, besides the direct evidences of inflammation (vol. iii. p. 260), and the rare examples of lymphatic fistulæ (vol. iii. p. 259), the chief phenomena to which attention is called in diagnosis are those of simple inflammatory or specific enlargement of the glands.

The errors which may be committed in the interpretation of these symptoms are very numerous. Thus the sudden stoppage of the arterial circulation may be due to embolism and not to accident; the enlarged vessels around a vascular tumour, though they pulsate, may be some of them veins;* the thrill referred to anæmia may be due to aneurism; the venous enlargement and œdema may be due to simple retardation of the circulation, without positive obstruction; the glandular enlargement to irritation, and not to morbid deposit.

Digestive system. Besides the general indications which are to be drawn from the condition of the tongue and of the bowels, the symptoms which refer to the various portions of the alimentary canal occupy a high place in the diagnosis of many surgical ailments. The importance of studying the general condition in cases of constipation, in order to the diagnosis between mere mechanical obstruction, acute strangulation, inflammation, and simple inaction, will be appreciated by perusing the observations on that subject (vol. iv. pp. 152 et sqq.). Perhaps we ought also to illustrate the fact, that symptoms referable at first sight to the digestive system may be only reflex phenomena excited by disease or injury of remote parts. The familiar in-

* This has been particularly noted in arterio-venous aneurism, as in Mr. Moore's case quoted at vol. iii. p. 450; but I have seen the same thing in cirroid aneurism.

stances are the vomiting, which is symptomatic of early disease of the kidneys, and that which almost always follows on superficial injuries of the brain (vol. ii. p. 149).

Urinary organs. The general symptoms which are referred to the urinary organs are less important in surgery than in medicine, these symptoms being mainly confined to the cases of local disease of the organs, but not entirely so. A perusal of the essay on DISEASES OF THE URINARY ORGANS will show how numerous and complicated are the general phenomena which the Surgeon must master in order to the successful diagnosis of the affections of that system. With reference to the bearing of urinary phenomena on the general condition of the patient, the most practical example is the frequent disappointment which operating Surgeons experience from having neglected to examine the urine before proceeding to operation, and having accidentally performed a serious but avoidable operation on a patient labouring under Bright's disease. It ought to be a fixed rule never to operate on a case of chronic disease of a joint, to extirpate a large tumour, or perform any other operation which is not absolutely inevitable, without a previous careful examination of the urine.

Genital organs. The functions of the genital organs are disturbed almost exclusively by local diseases; but in the male sex a few general diseases react on the sexual system; an example of which is the atrophy of the testicles which follows mumps in some rare cases (vol. iv. p. 569), and occasionally succeeds injuries of the head (vol. iv. p. 609). In the diagnosis also of some affections of the brain, it is important to note the sexual symptoms; an instance of which is furnished by the perverted sexual appetites which are occasionally symptomatic of epilepsy, and are sometimes regarded as its exciting cause (vol. iv. p. 606).

Locomotive system. The locomotive system also furnishes us chiefly with indications comprised under the head of "Physical Examination," unless the skin be included under this term. Every symptom connected with this great eliminant organ should be most carefully noted in the first and in all subsequent examinations of the patient. Its heat, dryness, harshness, colour, state of circulation, presence of eruptions, and a host of other particulars too numerous to mention, furnish diagnostic indications of the greatest importance.

Miscellaneous. Finally, there are some miscellaneous symptoms which cannot be referred to any of the organs of the body, but which may have a considerable influence on the diagnosis of the disease.* Thus the condition of restlessness and malaise which accompanies inflammatory fever (vol. i. p. 45); the cachexia which is so striking in some cases of cancer (vol. i. p. 537); the general physiognomy which is to a certain extent characteristic respectively of hysteria (vol. i. p. 361), of struma (vol. i. p. 346), and of secondary or constitutional syphilis (vol. i. p. 425); the tendency to symmetrical occurrence in certain diseases (*e.g.* hypertrophy of the bones of the face, vol. i. p. 494), are particulars not to be referred to any distinct system of organs, but which it would be extremely inaccurate to overlook in forming a diagnosis.

III. *Physical Examination.*

Our third elementary division refers to the physical examination of the diseased parts. As this must of course be done by the Surgeon's senses, it is convenient to refer to the main particulars under the head of the special sense by which they are perceived: as those which are discovered by the sight—alterations in form, in colour, in volume, in shape, in transparence, and here we must speak of microscopical and other instrumental observations;

* A few of these miscellaneous particulars would, in our scheme (pp. 944-46), be referred to under the head of "Remarks;" the greater number would find a place under the heading "Aspect."

by the touch—alterations in consistence, in relation, in volume, in pulsation, in mobility; by the hearing; and by the smell.

To these we ought to add chemical examination, in which all the above senses are employed. This method of examination has superseded the disgusting applications which were made of the sense of taste by the medical practitioners of a former day, so that this sense bears no part in diagnosis.

The microscope. Let us commence this long list of particulars by the visual phenomena; and first of the artificial aids to vision. There are a great many cases in which the Surgeon has to make use of the lens in forming his diagnosis. For persons of not very sharp sight, a convex lens is unnecessary in examining the eye for minute foreign bodies, colourless hairs, crab-lice, and on other such occasions; and its aid is invaluable in throwing an oblique light into the eye, to examine the capsule of the lens and the contents of the posterior chamber. In skin-diseases also a lens is very frequently serviceable.

The use of the microscope in surgical diagnosis is a matter on which practical men differ extremely. Like most other things, in this age of minute research, the microscope has become a speciality in practice, and is therefore decreed by those who know little of its use, and exaggerated in importance by those who know little else. But the truth lies, in all these cases, between the extremes. What was at one time believed to be the special province of the microscope in surgical diagnosis, viz. to distinguish between cancer and innocent tumours, has been found to be a problem beyond the unaided powers of the microscope; and, in fact, as our knowledge of the subject has advanced, the sharp line which was formerly thought to separate malignant and innocent tumours has become less distinct, and it is generally allowed that there are forms of disease which partake of the character of both (vol. i. p. 504): yet the value of a good microscopical examination of a tumour has been fully established, though it is now considered as, in many cases, only one of numerous diagnostic signs, to be used along with the history, the naked-eye characters, and the relations of the tumour, in forming a judgment as to its nature; and in that connexion of very great importance, although not to be trusted to alone in complicated cases. There are numerous simpler cases of tumour in which microscopical examination alone suffices for diagnosis; but in many of these cases the diagnosis can also be performed without its aid. All this refers to tumours after their removal from the body; but in the living body also it is often possible to remove a very small portion of the tumour for microscopical examination; and such a method is occasionally made use of (vol. iv. pp. 507, 914).

It is, however, in the examination of the fluids of the body, and of substances discharged or said to be discharged, that the microscope has its most undoubted and most important use. The pathology of urinary affections rests almost as much upon microscopical indications as upon all other methods of examination put together. The presence of pus-globules, of blood-globules, of epithelium, of spermatozoa, of animalcules, of fungi, and of other microscopical objects too numerous to mention, in matter evacuated naturally or artificially, often materially assists or even alone establishes the diagnosis of a case; while innumerable instances of delusion and trickery, in which foreign substances are alleged to have been passed from the mouth, urethra, vagina, and rectum, can only be distinguished from those which are real by its agency; and in the latter case the microscope alone can establish the diagnosis, and thereby perhaps relieve the patient from the fear of an internal tumour, who may have simply passed a shred of undigested meat from his bowels; or announce to one in whom an intussuscepted portion of intestine has been passed the possibility of recovery of health; or again warn the friends of another in whom organised and apparently malignant structures may be passed from the anus that these are probably the fragments of some hidden tumour in the bowel; or in whom small fragments of faeces may be detected in the urine that these prove the existence of a communication between the bowels and bladder (vol. iv. p. 349).

In skin-diseases again the microscope is indispensable, and has doubtless rendered to that department of pathology the best service which it has received of late, by clearly marking out certain diseases as local, depending on the presence of a parasitic plant or animal, and therefore in all cases curable by simple local measures directed to the destruction of the parasite (vol. iv. p. 725).

The above is not meant as an exhaustive enumeration of the uses of the microscope in surgical diagnosis, but merely as a specimen of its chief applications; and it justifies us in saying, that though a man may be a very good Surgeon without being any thing of a microscopist, yet the highest attainments in diagnosis cannot be within the reach of such a one.

Ophthalmoscope, &c. Of the diagnostic value of the inventions for examining special organs it is needless to say any thing here, since a reference to the essay on DISEASES OF THE EYE will suffice for the ophthalmoscope; to DISEASES OF THE EAR, for the speculum auris and otoscope; and so on. One word may perhaps be added with respect to one of these instruments, the use of which has excited much contention—the speculum vaginæ. Although there can be no doubt that the examination of women, and especially unmarried women, by this means, has been carried to a most unnecessary, indecent, and reprehensible extent, both in this country and elsewhere, its use cannot on that account be dispensed with, in appropriate cases. Those which fall under the care of obstetric physicians need not be spoken of here. The main uses of the speculum vaginæ in surgery are to examine the vagina and neck of the uterus for sores, in case of discharge after suspicious intercourse, to examine and expose tumours situated about the os uteri or in the wall of the vagina, and in plastic operations on the vagina.

Alterations in form. The Surgeon ought to be so intimately acquainted with the natural form of every part of the body, that any variation, beyond those natural minute differences which constitute individuality, should arrest his attention at once. Striking instances of the importance of recognising any little alteration in form due to disease may be found in every part of surgery. Thus the slight fulness caused by a strangulated obturator hernia was noticed by Mr. Obré as constituting a difference between the two femoral fossæ, and led him to the happy idea of cutting down upon and liberating the constricted knuckle of intestine (vol. iv. p. 320).

Colour. The natural colour of parts is composed of the colour of the blood circulating in them, and that of any special pigment they may contain, seen through varying thicknesses of skin or through mucous membrane. Hence variations from the natural hue may be caused by alterations in the mass of blood (pallor and redness), or from detention of blood in the part (lividity and ecchymosis), or from absence or undue deposit of pigment (of the former of which albinism may be taken as an example, of the latter melanosis, the cutaneous maculæ, Addison's disease, vol. iv. p. 758), or from undue thickening of the cuticle, or cutification of the mucous membrane (as in prolapsus vaginæ).

Volume. The alterations in the volume of parts depend either on hypertrophy of their natural elements, or on fluid or air effused into their interstices, or on the organisation of inflammatory products, or on the pressure of a new formation. In distinguishing these various particulars from each other, the touch must often come to the assistance of the sight. The hypertrophy of the skin and cellular tissue which constitutes elephantiasis can indeed be recognised by the unaided sight; but in order to distinguish between the thickening of hypertrophy (so called) of bone, and that of periosteal deposit, the part must be carefully examined with the hand; so of the swelling of œdema or emphysema, of dropsical effusions, of chronic inflammation, and of tumours.

Transparency. The familiar instance in which transparency is used as the test of the nature of a disease is hydrocele; but in a few other cases it is also employed, as in cysts in the popliteal space, occasionally. Opacity also is a

phenomenon which is still more frequently noted by the Surgeon, and more especially in the humours of the eye.

Consistence. Alterations in consistence are, amongst all other tactile indications, those from which diagnosis derives most frequent assistance. It would be endless to enumerate all of them: the softening or hardening of different stages or varieties of inflammation, the flabbiness of atrophy, the rounded softness of fat, the boggy feeling of gangrene,—are among the most familiar illustrations. Some among these tactile phenomena, however, deserve special mention, viz. emphysema, crepitus, and fluctuation. The former is the peculiar crackling which denotes the presence of air in the cellular tissue. It is a sensation which is often to be met with, and which, when once known, can hardly afterwards fail to be recognised, since there is nothing else exactly like it. It is a kind of crepitus, but cannot be confounded with that sensation. Its most common cause is the escape of air from the respiratory organs into the cellular tissue; and it becomes a sign of importance in wounds or contusions of the neck and injuries of the chest, proving the existence of a wound of the trachea, a fracture or rupture of the larynx or some lower part of the tube, an injury of the lung in cases of fractured ribs, an opening of the pleura or a wound of the lung in penetrating wounds of the chest. But there are many other causes of emphysema. It occurs, though rarely and only to a limited extent, around punctured wounds in any part of the body, or around the opening of an abscess; it may be caused by a wound of any part of the gastro-intestinal tract,* and is one of the symptoms of the decomposition of the tissues in gangrene.

Crepitus is a name given by Surgeons to the crackling produced by the rubbing of two rough surfaces together. When used in a surgical description without any qualifying adjective, it is intended to signify the rough grating which is produced by the friction of two exposed bony surfaces on each other. It is, therefore, pathognomonic of fracture in a case of recent injury, and of erosion of the cartilages and ulceration of the exposed bony surfaces in a case of joint-disease. There is no sensation which can be confounded with this kind of crepitus, nor any ambiguity in the indications to be drawn from it. But besides this fresh rough bony crepitus there are other kinds of crepitus, indicating different conditions, and sometimes rather difficult to make out. The effusion which follows inflammation of the sheath of a tendon produces a kind of crepitus which, in its simplest form, is very easy to distinguish from bony crepitus, it being more of a creaking than a crackling, and obviously produced by the rubbing of soft though somewhat rough surfaces together (vol. iii. p. 544). As the lymph which produces the sensation becomes drier and harder, the crepitus becomes rougher, but never attains the crisp decided feeling of the crepitus of a recent fracture. But the crepitus of a fracture becomes less crisp and decided as the bony ends get rounded off and coated with soft matter. Hence in injuries which are not recent, it is often difficult, and sometimes impossible, to decide whether the crepitus is from effusion in sheaths of tendons or in joints, or whether it is from fracture. This is particularly the case in the examination of injuries of the shoulder-joint some time after their infliction.

Again, crepitus is produced in old rheumatic disease of the joints; but it is usually easy to distinguish this from the crepitus of caries; for this crepitus being due to the rubbing of the 'additamentary' pieces of bone on each other is far freer and more decided, and is obviously caused by portions of bone far more movable than the carious surfaces of a joint can be. I have seen a case in which the sound produced was so loud that it could be distinctly heard at some distance (vol. iii. p. 727).

The most important of all the diagnostic signs dependent on the touch is

* After a wound of the rectum made in puncture of the bladder per rectum, I have seen emphysema occur and extend up to the chest; so that the feeling of the parietes of the thorax was just what is perceived in cases of fractured ribs.

fluctuation, or the sensation of fluid enclosed in a cavity. This sensation depends on the well-known properties of a fluid, viz. that its particles are movable on each other by the slightest possible force, or, in other words, that a fluid has no cohesion, and that it is incompressible. The most perfect example of this sensation is where thin serum is enclosed in a moderately tense bag, as in the case of a large ascites. In such a case, if a finger be firmly laid upon any part of the bag, the least tap given to any other part of the bag with the fingers of the other hand will cause a distinct wave of fluid to strike the first finger. This is the most usual way of ascertaining fluctuation, and the most certain; but of course it is not available for limited and deep-seated collections. Smaller collections are more usually tested in this manner: alternate pressure is made with the fingers of the two hands; when one finger is pressed down gradually and firmly on the collection of fluid, the latter, being incompressible, transmits the pressure, however slight it may have been, to the other finger; and the sensation of a rounded elastic body is communicated to that finger. This sensation is usually verified by repeating the proceeding with the two hands alternately. Care must be taken not to forget that the elastic reaction of the fluid is perceived, not by the finger which is making active pressure on the tumour, but by that which is lying still on its surface, and therefore to direct the attention to that finger. The perfection of the sensation depends on the fluid being enclosed in a capsule, and on its not being too deep-seated. When the quantity of fluid is small and deep, another method is often used. This consists in pressing the end of the finger sharply down upon the supposed fluid and suddenly withdrawing it a little, when the wave of fluid which was driven down by the push of the finger will rise up and strike against it.

It is in his accurate perception of fluctuation that the Surgeon chiefly shows his tactile accomplishment. But there are many cases in which it is very difficult to decide upon the presence of fluctuation, and many in which it is impossible. Nor need this appear strange if the cause of the sensation be considered. It depends mainly on the fact that the particles of a fluid are movable on each other by the slightest possible force; that it has no cohesion. But this, though true of the pure fluids with which physical reasoning is conversant, as the pure serum in the above instance, is by no means true of the mixed substances sometimes found in the body, of which it is difficult to say whether they are more fluid or solid, and which are very soft and very elastic, but still can hardly be said to have no cohesion or to be incompressible. Thus in some very soft tumours, almost of creamy consistence, such as the most rapidly-growing of the cancerous tumours of the liver, it is impossible, even after they have been removed from the body, to say whether they fluctuate or no; and in the soft mass of granulations into which the synovial membrane of the knee is converted in the gelatiniform degeneration, it is hardly possible to say whether the soft mass does or does not contain one of those limited collections of fluid, so often found there, without the use of the grooved needle.

The latter instrument should always be used in such cases, and will clear up any doubt which the Surgeon may feel.

Fluctuation may also be prevented by the thickness of the sac in which the fluid is contained, as in some old hydroceles; or by the extreme tension of the sac preventing the slight displacements which are essential to the undulation of the fluid. This, also, is often noticed in hydrocele. The extreme depth of the collection, again, and the mass of soft parts covering it, may so obscure the sensation as to prevent any confident diagnosis. In order, therefore, to avoid errors as far as possible, and to avoid the appearance of error in circumstances where an accurate diagnosis may be unattainable, the Surgeon must be very careful to familiarise himself with the numerous circumstances in which fluid may be present without fluctuation being felt, and, on the other hand, where a deceptive sensation of fluctuation may be elicited from soft and elastic solids.

Relation. Changes in the natural relations of parts are appreciated chiefly by the touch, though this is often assisted by sight and occasionally by hearing. They chiefly refer to those alterations in the position of prominent points of bone which are produced either by violence in fracture or dislocation, or by muscular action in diseases of joints and in some affections of bone. In the exploration of the abdomen for tumour or to diagnose the seat of obstruction, and in exploration of the chest with reference to the diagnosis of fluid in the pleura, the ear also comes into play. Beside the actual changes in position, changes in the direction of bones become sometimes of much consequence, as in the diagnosis of dislocations of the shoulder. In some chronic diseases, also, the relations of parts undergo changes which it is of the utmost importance to anticipate and discover. A notable instance of this is the displacement which the femoral artery sometimes suffers in chronic abscess of the thigh, where the vessel has been wounded by the very care which has been taken to make the incision away from its normal course.

Mobility. Alterations in mobility depend on the solutions of continuity of bones, ligaments, or fasciæ, on the one hand, whereby parts which ought to be fixed become movable; or, on the other, on chronic inflammation, leading to adhesion or ankylosis, by which movable parts become fixed. The most common illustration of unnatural mobility is that of fracture; and perhaps the most perfect instance of the diagnostic value of loss of natural mobility is in early disease of the hip. When other symptoms might be doubtful, the contrast in mobility of the sound and diseased joint will usually at once clear up the case.

Pulsation. The alterations in pulsation have been already spoken of, under the symptoms referable to the organs of circulation. Every opportunity should be taken of studying the various kinds of unnatural pulsation which are noticed in diseased vessels, and of verifying by post-mortem examination the morbid conditions on which they may depend; such as the expansive pulsation of ordinary aneurism, the obscure thrill of extravasation depending on ruptured artery, the vibrating and purring thrill of arterio-venous aneurism, the tremulous movement often perceived in the large arteries (chiefly the abdominal aorta) in anæmia.

Sound. The faculty of hearing is to be employed in many parts of surgical diagnosis, although it may be less important than in medical diagnosis. The use of the stethoscope ought never to be neglected; and every opportunity should be taken for becoming familiar with the healthy and morbid sounds, and for tracing on the dead body the causes upon which the latter depend. The great importance of the bruit in the diagnosis of aneurism is the most striking instance of the employment of the ear in surgery; but it must not be forgotten that aneurisms exist without bruit,—in fact the most numerous class of aneurisms, the thoracic, are very frequently devoid of all sound,—and that also (but much more rarely) bruit exists without aneurism, as in some cases of tumour pressing on a large artery (vol. iii. p. 382). In cases of suspected stone, the ear gives the most definite and unmistakable evidence of the presence of the foreign body. In necrosis the ring of the probe against the hard exposed bone is very characteristic. In cases of injury to the thorax auscultation becomes occasionally indispensable; and in a few other circumstances the sense of hearing furnishes useful data.

Smell. The province of this sense in diagnosis is very limited, since, though peculiar odours are associated with many morbid conditions, their other symptoms are quite sufficient to distinguish them, or if not the diagnosis could not be established by the odour. Perhaps favus may be an exception, in which the peculiar mouse-like smell is considered as a characteristic of great value. Some Surgeons attribute much importance to the smell of matter discharged from a sinus, as indicating, by a peculiar sanious odour, that it proceeds from a carious surface of bone; but too much importance is not to be attached to this.

Chemical examination. The province of chemistry in establishing the

diagnosis of surgical ailments is not very extensive, although in confirming that diagnosis, and in suggesting a rational plan of treatment, it is frequently useful. In urinary diseases, indeed, some chemical examination of the secretion is necessary; and the same may be said in cases of stone: but there are few other instances in which chemical analysis is necessary in the ordinary exigencies of surgery. In medical jurisprudence, however, chemical examination is indispensable in almost every case.

Such are the chief sources of surgical diagnosis; and in order not to overlook any of them in examining the cases which come before him, it is useful for the student at the commencement of his practice to be prepared with a form which may embrace them all, and suggest them to the examiner. Such forms are still more useful in the registration of hospital-cases, where reference is so much facilitated by uniformity of system. Accordingly, I have subjoined a form for the registration of cases, which was devised by Dr. Bristowe, to whose kindness I am indebted for its insertion. It has been in use for some years at St. Thomas's Hospital, and is adapted both to medical and surgical cases. An example of a case of either kind is therefore inserted on the form. These forms are intended to serve also as indexes to the detailed notes of the more important cases, which would of course be taken at considerable length and numbered. The numbers of these detailed notes and those at the head of the column appropriated to the case in the table would be the same, and thus a reference to the symptoms connected with any of the main headings in the table would at once give all the morbid phenomena connected during life with each organ or system of organs. The post-mortem register would be arranged on the same plan, and a second reference to it would give all the morbid appearances with which these phenomena were associated. Thus, if the lines are traced horizontally, they give a succinct account of the morbid conditions of the various organs, and references to a more accurate and detailed account of those conditions; while if the columns be read vertically, they give a succinct account of the symptoms connected with each particular disease, and (as before) a reference to a more copious account when necessary.

TABLE FOR REGISTRATION OF MEDICAL AND SURGICAL CASES.

NERVOUS SYSTEM.	1. Disease for which admitted - Duration.	1st attack. 1. <u>Acute rheumatism.</u> 3 weeks.	<u>Acute necrosis of femur.</u> 12 hours.
	2. Associated disease. Duration.	2. <u>Mitral-valve disease.</u>	<u>Pyæmia.</u>
	3. Result.	(1) Cured. (2) Nil.	Dead.
	4. Sex. Age. Occupation.	F. 16. S. Servant.	M. 5½. Child.
	5. Date of Admission. Date of Discharge. No. of days in Hospital.	Dec. 9. Jan. 24. 46 days.	March 29. April 9. 11 days.
	Brain.	Want of sleep at times from pain.	No sleep last 6 or 7 days; sensible to last.
	Spinal cord.		×
	Nerves.	Pain in many joints (shifting); pain in chest.	Severe pain in right thigh, and left side of face; and for short time in left wrist.
	Organs of sense.	×	×

TABLE *continued.*

ORGANS OF RESPIRATION.	Larynx and trachea.	×	×
	Lungs. Pleuræ.	Slight cough on admission. ×	Severe, incessant; loose cough last 3 days with short breath. Chest resonant.
	Expectoration.	×	None.
ORGANS OF CIRCULATION.	Heart. Pericardium.	Increased area of dullness (? effusion). No friction. <u>Syst. m. at apex 11 d. after admission, persistent.</u>	—
	Arteries.		P. about 160. Imperceptible last day.
	Veins and capillaries.		
	Blood.		
	Lymphatic system.		
ORGANS OF DIGESTION.	Tongue, mouth, and salivary glands.	T. furred on admission and for some time after.	T. moist, but furred. <u>Last 2 or 3 days dry.</u>
	Fauces, pharynx, and œsophagus.		Abscess on L. side in neighbourhood of fauces: opened day before death.
	Peritoneum.		×
	Liver.		No jaundice.
	Spleen, thymus, thyroid, and S. R. capsules.		
	Stomach.	Thirst and bad appetite when admitted and for some time after. <u>Gastrodynia.</u>	Want of appetite. No sickness.
	Vomitus.		
	Intestines.	×	B. not loose.
	Dejections.		
	Kidneys, &c.		
SEXUAL ORGANS.	Bladder and urethra.		
	Urine.		
	Male organs.		
	Ovaries.		
	Other female organs.		

TABLE continued.

LOCOMOTIVE ORGANS.	Muscular system.		Very feeble.
	Osseous,		Acute necrosis of nearly whole femur; opened 7th d. Acute necrosis near ramus of jaw. (Lt.) beginning Apr. 1st; opened Apr. 6th.
	Articular, and	Pain, redness, and swelling of many joints.	
	Fibrous systems.		
	Adipose and areolar tissues.		
	Integuments.	Perspiration.	Skin dry all along. A few sudamina.
	Aspect.		Face much flushed at beginning. Aspect of typhus.
	Operations and date of operations.		
	Remarks.	Treated with lemon-juice, then with potash, and occasional hot-baths.	Complained of illness 12 hours only before admission. First symptoms, pain in thigh coming on without obvious cause.
	Name of patient. Medical officer. Reference.	M. M. Lack. Dr. — —	J. Scully. Mr. — —

1. Duration, in the first two lines, is intended to be duration up to the time of entering hospital.

2. Practically, it has been found convenient to place information relating to "pain" (neuralgic, or of other kind) under the head of nerves.

3. Where two lines are bracketed the intention is that, in cases where it is impossible conveniently to separate the description of the two or three organs thus bracketed, the combined description shall either extend over the whole space or be limited to the central part of the space.

4. Where more than one organ or tissue is involved in the same disease, the fact should be repeated under each head; thus, when *joint-disease* is mentioned under its appropriate heading, it will be often proper to mention *caries* under head of bones.

5. It is sometimes desirable to give the duration of a symptom, or the time at which it commenced or ceased. This may be conveniently done by making the day of admission the starting-point of reckoning, and by speaking of time in days; thus, duration, 14 d. to 16 d., indicating a duration of three days inclusive, beginning from the 14th day after admission; or, 3 d. to 2 d., indicating a duration of five days inclusive, beginning from three days before admission.

6. A *line* placed under any remark indicates that the condition to which it refers is *important* or *grave*. And the degree of gravity may further be roughly indicated by the degree of thickness of the line.

7. A cross placed in any space indicates that the organ or part to which it refers was ascertained to be healthy.

8. A horizontal line similarly placed indicates that, from some oversight, the condition of the part to which it refers was *not* ascertained.

9. A D or an M placed in the corner of a compartment is used to signify that the notes of the case contain a *detailed* description or a detailed *microscopic* account relating to the circumstances contained in the compartment.

The importance of anatomical knowledge and anatomical examination in surgical diagnosis is greater than that of any other of the sources of diagnosis. This will be best illustrated by the following remarks on REGIONAL SURGERY.

ON THE REGIONAL SURGERY OF THE BODY.

The object of the following pages is to give, in as few words as possible, the main considerations by which the Surgeon ought to be guided in distinguishing from each other the affections of the various regions of the body, so far as those considerations depend on the structure of each region. Such a treatise, if completely executed, would embrace all the points at which surgery and anatomy touch each other, and would therefore extend over the greater part of the theory of surgery; but, as most of these points have been fully treated of in the body of this work, it will suffice for me here to give a general view of the leading features of the anatomy of each region, and to dwell more particularly on such diseases* as have not found a place in the previous pages.

Of the Head.

The regional anatomy of the scalp and skull is simple. The parts present merely a series of laminae overlying the cerebrum. These laminae may, for surgical purposes, be divided into the hairy scalp, including the skin and the tendon of the occipito-frontalis muscle, with the large vessels contained between them; the cellular interspace between this tendon and the pericranium, in which the smaller vessels ramify; the pericranium and skull; and the membranes of the brain. It is unnecessary to attempt here any summary of the well-known points connected with the normal anatomy of these various structures. The point of chief importance in the case of any morbid product in this region is to determine from which of the laminae it has sprung. This knowledge will of itself frequently determine the nature of the disease, and will at any rate give the most valuable indications as to the possibility of surgical interference.

1. The affections of the superficial layer—the hairy scalp—do not, as a general rule, lead to any difficulties in diagnosis; nor need the reader be detained here by observations on such affections as erysipelas, the cutaneous eruptions, the ordinary forms of naevus, of innocent tumour, or of cancer,—affections which have been treated of in other parts of this work.† Two only of the diseases of the scalp and its subcutaneous tissue appear to me to require notice here—viz. the congenital encysted tumour perforating the skull, and some of the rarer forms of vascular pulsatile tumour.

The congenital cutaneous cysts have been referred to in the essay on TUMOURS, vol. i. p. 472. Their frequent occurrence in the orbit, and their occasional communication with the cranial cavity, has been noticed in that essay. A similar (but usually larger) perforation sometimes exists in the skull, below a tumour resembling in all respects, before removal, the ordinary sebaceous tumour of the scalp, but congenital. It is not to our present purpose to discuss whether the hole in the bone is the result of pressure while it is in a membranous condition, or of original imperfect development. The practical effect is the same, viz. that the tumour lies on the dura mater. The removal of the tumour is not on that account to be absolutely discountenanced, but its important relations call for increased care in the diagnosis and treatment of such of these tumours as are congenital. They are generally

* It must be remembered that all injuries will be found in our second volume, described in the same regional classification as that which is here adopted.

† I may perhaps notice that almost all the affections of the scalp are essentially cutaneous, and that the malignant affections are exceedingly rare. Almost all tumours are of the encysted variety; but I have met with a fatty tumour here.

brought under the Surgeon's notice in childhood. The main questions, in a case of congenital tumour of the scalp, are, first, whether the tumour is dermal or encephalic; secondly, allowing it to be dermal, whether it perforates the bone or no. Great care should be taken in examining any congenital tumour lying in any of the ordinary situations of encephalocele; and if such a tumour (not being a *nævus*) partakes in any obvious degree in the respiratory movements, still more if pressure produces any evidence of cerebral disturbance, it is far more wise to abstain from interference, except in case of evident necessity; such as the extension of the growth downwards, and the onset of more evident cerebral symptoms; when an operation may be proposed as a last chance, after its dangers and uncertainties have been clearly set before the child's parents. A tumour in other parts of the scalp, which is rounded, movable, non-vascular, not swelling up with crying, coughing, &c., and in which pressure does not affect the brain, may fairly be pronounced dermal. In a few such tumours, the finger-nail insinuated underneath the base will detect a depression in the skull. As such a depression may be of the outer table only,* it does not absolutely contra-indicate operation; but it would be advisable before operating to be satisfied of the decided increase in size of the tumour. Even if no depression can be felt, the skull may still be perforated; so that great caution should always be used.

With respect to the pulsatile tumours of the scalp, which are formed by dilatation of the large arteries below the skin, their anatomy and treatment has been described in the essay on ANEURISM, vol. iii. p. 454; and an allusion has been made to the occasional difficulty of distinguishing them from malignant tumours of the skull, in the essay on DISEASES OF THE BONES (*ibid.* p. 680). The presence of cerebral symptoms on pressure is a clear diagnostic mark, and ought absolutely to forbid any operative interference; but any appearance of morbid action in the skull at the seat of the tumour—more particularly thickening without signs of inflammation—should render the Surgeon very cautious in his diagnosis.

2. The occipito-frontalis tendon forms, in an anatomical description, the second of the layers of tissue which protect the brain: but as the surgical affections of this tendon could not be distinguished from those of the skin to which it is firmly attached, it may be neglected in this place. We come then to the cellular interspace between the tendon and the pericranium, to which the tendon stands in the same relation as the deep or muscular fascia does to the cellular interspaces in the other parts of the body. In this interspace the most ordinary affection is the diffuse inflammation so common after scalp-wounds; but this has been already treated of in the essay on INJURIES OF THE HEAD, vol. ii. p. 97. Effusions of blood sometimes take place in the same space, and lead to interesting questions of diagnosis and treatment. Such effusions, as far as I have seen, occur only in early childhood, and are probably always the result of accident: although the occurrence of the blow or fall may not always be known, since no mark may have been left. The fluctuating swelling may extend over the whole scalp, or over a large part of one side of it, being generally more prominent in the temporal region.

When this blood-tumour extends over the whole head, I have seen it mistaken for hydrocephalus—from which, however, there should be no difficulty in distinguishing it; since the forehead has not the characteristic shape of

* Mr. Athol Johnson mentions four cases of these perforating sebaceous tumours. In one, at an operation for sebaceous tumour of the scalp, the bone was found perforated, the dura mater was injured, and the patient died. The case occurred abroad. The preparation was presented to the Royal College of Surgeons by Mr. Prescott Hewett. In two other cases, Mr. Johnson, in dissecting out sebaceous tumours, found a small perforation in the bone beneath them. No ill consequences occurred. In the fourth case, in an infant who died from other causes, a sebaceous tumour was found lodged in a depression in the bone just above the orbital arch, but not perforating the bone (*Lectures on the Surgery of Childhood*, p. 15).

that disease, the bones are not thrust out, and the skull can generally be detected underneath the fluid. From cephalæmatoma it may be diagnosed by its position, since the latter is confined in ordinary cases to the parietal bone; by the history—the one being congenital, the other usually not; and by the absence of the defined ridge which encircles a cephalæmatoma. When a large artery has been injured, these blood-swellings sometimes pulsate, and increase very rapidly in size, so as to require active treatment. Two courses are then open: either to cut across the swelling, and endeavour to find the wounded vessel; or to tie the vessel at a higher point. The latter course is only possible when pressure on some branch (most probably one of the superficial temporal arteries) will arrest the pulsation. In such a case Mr. Athol Johnson tied the temporal artery with complete success. The tumour was of large size; and to have laid it completely open and evacuated the contents would have been a severe operation, and possibly might have been accompanied by a good deal of hæmorrhage.

In ordinary cases little treatment is required.* Under the use of evaporating lotions, the tumour gradually subsides. But if it continues in a chronic condition, it is justifiable to puncture and empty it; employing at the same time carefully-adjusted pressure. I once treated such a case in this manner, and had the opportunity of dissecting the parts a few months afterwards, the child having died of another disease. I found no traces of the collection of blood, except some decolorised fibrin and a few stratiform clots, bound down by a layer of false membrane.

3. The next layer of tissue is formed by the pericranium and skull. The blood-tumour, which is produced by pressure on the infant's head during delivery, and which is called cephalæmatoma, is smaller than the subaponeurotic extravasations above spoken of, appears in a few hours after birth, is situated on the parietal bone, and is bounded by a distinct ridge. The same ridge, bounding a small round circumscribed collection of fluid, is also familiar to surgeons as a frequent symptom in blows on the head, and a frequent cause of mistake to inexperienced observers, who confound these appearances with those of depressed fracture (see vol. ii. p. 105). Such extravasations from blows always disappear spontaneously; nor is there any more reason for surgical interference in cases of cephalæmatoma.†

The affections of the skull are by far the most frequent and the most important of those which attack this region. They may be divided into—1. the results of simple inflammation, acute or chronic; 2. scrofulous affections; 3. syphilitic affections; 4. tumours, innocent or malignant. Possibly also simple hypertrophy might be added to the list; but I have never been able to satisfy myself of the existence of this affection apart from the results of chronic inflammation.

The diagnosis and treatment of these affections may be thus stated in a tabular form:—

[See Table overleaf.]

4. After the affections of the skull come those diseases of the cranial contents which fall under the notice of the Surgeon, that is to say, the tumours projecting through the cranium. Inflammatory affections of the meninges arising from constitutional causes, and the distension of the membranes or of the ventricles of the brain from hydrocephalus, come more properly under the notice of the Physician; nor can we here enter upon the wide question of their diagnosis and treatment. The intracranial inflammations which follow injuries are treated of at vol. ii. pp. 179 et sqq. Our present subject will comprise congenital tumours arising from malformation, meningocele and

* On the treatment of blood-tumours reference may be made to the essay on CONUSION, vol. i. pp. 574, 7.

† For a more full account of cephalæmatoma the reader is referred to Dr. West's *Lectures on the Diseases of Infancy and Childhood*.

TABLE OF THE CHIEF SURGICAL DISEASES OF THE SKULL AND PERICRANIUM.

DISEASE.	LEADING SYMPTOMS.	DIAGNOSIS.	TREATMENT.
Acute inflammation: periosteal.	Very severe pain, especially nocturnal; sense of tension; much tenderness; slight swelling, bound down firmly by pericranium.	From tumour of brain or membranes, by its more rapid course, and absence of cerebral symptoms. From simple cephalalgia or neuralgia, by the swelling; the persistence and regularity of the symptoms, and the constitutional disturbance. From the situational disturbance. From the following, by the absence of suppuration and of symptoms of implication of the brain and membranes.	Free incision into swelling, with constitutional measures.
" "	As above: with rapid formation of pus, and probably irritation or suppuration on the other side of the bone, with cerebral symptoms. In rare cases, ulceration of the middle meningeal artery occurs, followed by hemiplegia.	This may be inferred from the preceding.	Free incisions. Trephining is imperative, when symptoms of pressure are clearly marked, and may be justifiable in some cases of mere irritation.
Ulceration	Inflammation, with suppuration,* followed by perforation of the skull, and in rare cases hernia cerebri.	In rare cases, when hernia cerebri occurs before the skin has given way, the disease has been mistaken for malignant pulsatile tumour. V. infra.	To attend to the general health, and relieve pain by incisions where fluid is apparent.
Chronic inflammation and hypertrophy	Rarely any symptoms: coma has been observed occasionally; but its connexion with the state of the skull has not been demonstrated.	Obscure.	No treatment is possible, except for the brain-symptoms, which (as their cause would be obscure) must be treated as they arise.
Necrosis and caries		Obvious.	When symptoms of cerebral irritation are present, the bone (especially when not implicating the whole thickness of the skull) may be removed.
Scrofulous affections:† of the tumour of the skull.	A large hard swelling, on the side of the head, much resembling an exostosis; but accompanied by headache, and symptoms of low inflammation in a scrofulous person.	From diffused exostosis, by the less-circumscribed character of the swelling, and the presence of symptoms; but mainly by the effect of treatment.	Blisters or iodine to the part. Iodine, with iron, or cod-liver oil, internally.

tions† of the internal table.	rare cases hæmorrhage from middle meningeal artery; with other symptoms of constitutional syphilis.	A small and very hard tumour growing very slowly, and unaccompanied by any symptoms except in very rare cases, when the exostosis grows from both tables, or in the orbit when it displaces the globe.	only to be diagnosed with certainty by a surgical operation.	be justifiable to trephine at the seat of pain; or in still more rare cases, over the middle meningeal artery.‡
Tumours: innocent: exostosis	A slowly-growing tumour, more soft than exostosis, and more liable to affect the brain by growing inwards.	From diseased enlargements of the bone by the presence of symptoms in the latter, and by their less distinct and circumscribed outline.	From exostosis as above: from cancerous tumours by its less rapid growth, and by the other usual diagnostic marks: from fibrous tumour of the dura mater the diagnosis is obvious before perforation of the skull has taken place, but impossible afterwards.	Operative interference is seldom justifiable.
fibrous or fibro-cystic	The same observations apply to the symptoms, diagnosis, and treatment of these forms of tumour, with the exception that their course is more rapid, and that in all other respects they bear a closer resemblance to malignant disease.	From innocent tumour by its more rapid course, and by the constitutional symptoms. From hernia cerebri, following absorption of the skull (very rare), by the greater violence of the pulsation, the absence of the movement of the brain dependent on the respiration, and the less uniform consistency of the tumour. From vascular tumour (or aneurism by anastomosis), by the cerebral symptoms which are induced by pressure, as well as by the signs of cancer.	No interference is permissible. Life may be prolonged many years even after the tumour has produced pressure on the brain and cerebral symptoms.	No treatment is possible.
myeloid or fibro-plastic.	Circumscribed pain in head; soon followed by the appearance of a tumour, or by softening and pulsation at the seat of pain. The tumour grows rapidly, and soon produces pressure on the brain. The malignant cachexia is usually well marked. The skull is usually thickened around the tumour.	No treatment is possible.	No treatment is possible.	No treatment is possible.
malignant.	No treatment is possible.	No treatment is possible.	No treatment is possible.	No treatment is possible.

* In one case, much resembling ulceration of the cranium, there seems to have been no suppuration previous to the incision. See Caesar Hawkins, in *Med.-Chir.*

† Such as described and figured by Mr. H. Lee, *Proc. of Med.-Chir. Soc.*, vol. iii. p. 283; *Path. Soc. Trans.*, vol. x. p. 8.

‡ See a case by Mr. H. Lee, *Med. Times and Gaz.*, Jan. 29, 1859.

encephalocele, and the numerous forms of tumour which were originally described by Louis as fungous tumours of the dura mater; to which a few words on chronic hydrocephalus must be added, in order to illustrate and explain the surgical operation of paracentesis capitis.

Encephalocele and meningocele are tumours formed by a hernia of the membranes of the brain through the skull, in one of the parts where the bones are deficient in early life. In encephalocele a portion of brain also lies outside the skull, while in meningocele nothing protrudes except a bag of the membranes filled with subarachnoid fluid.

The tumours so formed are soft, rounded, bluish in colour where covered by thin skin,* and from their congenital formation, their colour, and their increase in size when the child cries, are often mistaken for nævus. It is also often difficult to distinguish them from congenital encysted tumours, and sometimes perhaps impossible before operation.

The pathological anatomy and diagnosis of such tumours is an important and interesting question, to which much attention has been paid by Mr. Prescott Hewett, who has explained the subject very clearly in a course of lectures delivered by him as Professor of Surgery at the College of Surgeons, but not yet published.† I cannot affect to add any thing to the information then first collected on this head, nor in the space at my command even to adequately sum up all the points connected with it; but must be content if I can succeed in indicating those of the chief practical importance.

That which appears the leading consideration in the anatomy of these hernial tumours is the condition of the contained organs; since if these could be known or assumed to be healthy, treatment might be thought of, and *vice versa*. It is important, therefore, to know that in hernial tumour of the skull, even if nothing but the membranes protrude, yet there is almost, if not absolutely, always more or less of internal hydrocephalus. In a preparation in the Museum of St. George's Hospital a cyst is seen adhering to the skull by a pedicle which runs down to the anterior fontanelle, the situation of the fontanelle being occupied by a large Wormian bone, which nearly closes it.‡ The pedicle of the tumour is entirely solid, and the cyst was punctured during life without any detriment, though without benefit. From the length of the pedicle, and the perfect closure of the orifice of communication, there can be no doubt that this tumour might have been removed by operation with fair prospect of success, in fact the meningocele may be said to have been spontaneously cured. Yet the patient died at the age of six weeks; and on examination there was found a large collection of fluid circumscribed in a part of the arachnoid cavity, and communicating with a dilated lateral ventricle through an opening in the distended corpus callosum. In another preparation in the same Museum, the cyst which is in the occipital region contains no brain, but it leads through a small opening into the cavity of the fourth ventricle, which, as well as the whole ventricular cavity, is enormously dilated. Therefore, in the case of infants, the first point to be remembered is, that there is every probability of the presence of internal hydrocephalus; and it is not until, by long watching of the case, the perfect mental and physical power of the patient is ascertained, that the question of surgical treatment ought to be discussed.

The next question of primary importance in the anatomy of such a tumour is, whether or no the brain protrudes into the sac. It is only seldom that the pulsations of the brain can be detected :§ when this is the case, there can

* In these tumours, as in spina bifida, the cutaneous covering may be deficient, and the membranes exposed; but this is still more rare in the head than in the spine. Bruns, *Hand. d. prakt. Chir.* vol. i. p. 701.

† The best published account of this subject is to be found in the work of Bruns above referred to.

‡ A drawing of the head, taken during life, is also in the Museum.

§ As in Mr. Shaw's case, in *Path. Soc. Trans.* vol. ix. p. 1.

be no doubt of the existence of hernia cerebri ; but in ordinary cases where no such pulsation is found, there is no reason whatever for assuming the absence of the brain from the sac. The mass of fluid lying over it may mask its pulsation, or the protruding portion of brain may be only a small piece rising only up to or just beyond the level of the skull.

The situation of such tumours is very variable. The most common is in the middle line, and usually at the back of the head, through an opening in the occipital bone behind the foramen magnum, at the junction of the four centres which form "the proral portion" of that bone ; but any of the membranous portions of the infant skull may yield to the pressure of the fluid collecting inside, and become the seat of the hernia. Thus encephalocele is seen at the root of the nose (between the two halves of the frontal bone), at the anterior or posterior fontanelle, between the frontal and sphenoid or temporal bone, &c. The tumours in the anterior and superior regions of the skull communicate with the lateral ventricle ; those in the lateral region with the lateral or the third ; those in the occipital region with the fourth ventricle. Hernial tumours have also been found in the base of the skull, probably communicating with the third ventricle.*

The diagnosis of these tumours rests first upon their congenital occurrence and position, at one of the membranous portions of the foetal head ; next upon their fluid nature ; thirdly, upon their considerable and decided increase in volume or tension with strong expiratory efforts ; fourthly, upon their reducibility in part or entirely ; and fifthly, upon their sharing in the motions of the brain. All the three latter marks will be absent from those tumours in which (as in the instance quoted above) the pedicle has been obliterated ; but such tumours cannot be accurately diagnosed : and in some other cases the diagnosis must be allowed to be very difficult. I have seen a congenital tumour, lying on the root of the nose, and rightly believed to be a common encysted tumour, in which, however, before operation, it was impossible to be quite certain of its nature. In another case the hernial tumour was cut into, in mistake for a sebaceous cyst, and a small portion of brain-substance, proved to be so by microscopic examination, was removed. Fortunately no harm ensued.

As to treatment, few Surgeons would propose to meddle with a hernial tumour of the brain, knowing it to be such, unless it was distinctly increasing, and the patient's life was obviously imperilled. Unfortunately this is just the case in which there would be least prospect of benefit ; since the rapid increase in the tumour depends, in all probability, upon the rapid secretion of fluid from the lining-membrane of the ventricles or the arachnoid ; and the obliteration of the tumour, if it could be effected, would only hasten the epoch of fatal pressure. But, in some very rare cases, it may be thought justifiable to interfere, even if the tumour is known to be connected with the interior of the skull, since it may be growing so rapidly and be so near bursting, that it may seem more dangerous to leave it alone than to operate on it. In such cases puncture of the swelling, and carefully adjusted support (rather than pressure) afterwards by means of a pad and bandage, of such materials as may be judged best, are the only justifiable operative measures. Tumours of this kind have been removed by excision and ligature, having been mistaken for other growths ; but this is not a course which should ever be knowingly followed. In all cases it is advisable to give careful support to the tumour, and to defend it from irritation or injury ; and in those tumours which are reducible, if no cerebral symptoms are produced by their reduction, an apparatus should be employed to keep them down to the level of the cranium. This has sometimes been followed by the ossification of the skullcap and the cure of the disease.†

Tumours of the dura mater and diploë. Since Louis wrote his celebrated

* Serres, *Journ. de Chir. par Malgaigne*, 1844, vol. ii. p. 335.

† Bruns, *op. cit.* p. 715.

memoir on fungous tumours of the dura mater,* the attention of Surgeons has not ceased to be directed to those perforating tumours of the head which Louis described under that name. It is obvious on reading that paper,† as well as on studying the specimens of such tumours preserved in our Museums, that several different kinds of tumours are included under this designation. They differ in nature, some being innocent and some malignant; and in origin, some being originally connected (as Louis thought they all were) with the dura mater, and others with the bone, having usually their primary seat in the diploë; but they agree in certain main leading characteristics, can hardly be diagnosed from each other except under very rare circumstances, and must be carefully distinguished from other forms of tumour. The main features on which their diagnosis is to be founded are, their noncongenital history, which distinguishes them from nævi and from hernial tumours; and their penetration of the skull, which distinguishes them from aneurism by anastomosis and from ordinary solid tumours. This penetration is manifested by the pulsation which they receive from the subjacent brain, or which those of them that are malignant and spring from the diploë may have in their own vessels, and by the cerebral symptoms which pressure on their surface produces. Sometimes the edge of the opening in the skull can be felt. They are seldom very prominent—often are hardly raised at all above the surface of the skull, but feel like softened pulsating spots in the bone; and they are either single or multiple. Those which are little, if at all, raised have been sometimes described as aneurisms of the bone;‡ but as to this, what was said in the essay on DISEASES OF THE BONES may be repeated here, that there does not seem to be a perfectly satisfactory instance of the latter alleged affection on record. Those tumours which pulsate actively, and especially those which are multiple, will usually be found to be soft cancer of a very vascular kind springing from the diploë. Those which receive pulsation from the brain are either soft cancer, or fibro-cellular or fibrous tumours, affecting the dura mater, and perhaps originating in it. Some of them, however, affect the bones of the skull to an equal or even greater extent, so that it is not easy to form an opinion as to their origin. A symptom which is often of value as distinctive of tumours penetrating the skull, but which is only met with at an early period, is the presence of a thin crackling parchment-like layer of bone over the tumour.

Some of these tumours have been met with, which have been entirely reducible within the skull. Nélaton§ gives a remarkable case, in which several such tumours formed, and disappeared temporarily, but grew again and proved to be cancerous.

If the question of the treatment of such tumours needs discussion, little can be said beyond urging the propriety of not meddling with them. This again might seem almost unnecessary; but it is surprising how often, either from mistakes in diagnosis, or from inability to resist the patient's entreaties, Surgeons do commit themselves to an attempt at such operations. Such attempts, however, are unjustifiable on every ground. It has been stated above that these tumours are innocent or malignant. In the former case, an operation will probably hasten death; and in the latter, it will certainly not retard it. The innocent tumours are by no means necessarily fatal. Thus, there is in St. George's Hospital Museum a preparation showing a fibrous tumour of the skull and dura mater, which had perforated the latter membrane and was lying on the brain, from which it received a very decided pulsation. The patient suffered from occasional fits, loss of memory, vertigo, and sickness; but he survived the appearance of the tumour more than fifteen years; and finally died, at a tolerably advanced age, of a disease quite unconnected with that on the skull. No operation could be of any avail

* Translated by Mr. Drewry Ottley in a volume of selections from the Memoirs of the Academy of Surgery of Paris, published by the Sydenham Society.

† Compare the cases numbered 1 and 19.

‡ *E. g.* by Cruveilhier, *Anat. Path.* liv. 33, pl. 4. § *Path. Chir.* vol. ii. p. 631.

short of one which would remove the whole of the skullcap around the diseased parts, and allow of the avulsion of the tumour from the dura mater; and although instances of recovery from such barbarous proceedings are on record,* they would not now be attempted. But to cut into a tumour of this sort, with no prospect of removing it entirely, is surely still less justifiable. In cancer no operation should ever be thought of, unless there is almost a certainty of removing the whole disease; and this rule is the more absolute, the more vital is the organ affected.

Hydrocephalus. Surgeons are sometimes consulted with respect to surgical measures in cases of chronic hydrocephalus; and hence it becomes necessary to say something in this place about this disease, as far as relates to its surgical treatment. The acute affections of the brain (encephalitis, acute hydrocephalus, or strumous meningitis, &c.) are so exclusively the province of the physician, that they will not be mentioned here; more especially as it would be impossible to do justice to the subject without more space than is at my command. The effusion in chronic hydrocephalus may be external or internal to the ventricular cavity; it may depend on malformation of the brain, on atrophy, on chronic inflammation, or on injury; and the curability of the disease depends so essentially on these circumstances, that they must be maturely weighed before an opinion for or against surgical interference is given. Cases of external hydrocephalus (*i. e.* of dropsy of the arachnoid cavity) are usually regarded as less hopeless than those of dropsy of the ventricles. The diagnosis of the two conditions is by no means certain in any case; in fact, Dr. West† says, that their symptoms are nearly identical; but some indications can be drawn from the history, and a probable guess at any rate may be formed from the appearance of the eyes. In those cases of hydrocephalus which are congenital there is usually extensive malformation of the brain, and the fluid may be expected to be found in the cavity of the ventricles, although it is not unlikely that there may also be fluid external to the brain. At any rate treatment will be useless. In cases, on the other hand, which can be clearly traced to injury, the probability will be that the fluid is external; and there will be more hope from treatment. In atrophy of the brain, the hydrocephalus will be external; in chronic inflammation, internal; but I know of no symptoms or facts from which these conditions can be diagnosed.

The aspect of a case of hydrocephalus is very peculiar. The fontanelle is widely expanded and often very tense; the sagittal and frontal sutures are opened out, and thus the two halves of the frontal bone are driven outwards, and the frontal eminences project on either hand, giving a peculiar square shape to the head, and great height to the forehead. The base of the skull is driven downwards; and thus the orbital plates of the frontal bone are pushed into the orbit, displacing the eyes, which look outwards and downwards, and are also more prominent than natural. Frequently, also, the eyes have that unsteadiness of action and vacant expression which accompanies partial blindness in infancy. The occiput is driven more or less downwards and backwards. On feeling the head, in an old-standing case, isolated patches of bone (Wormian bones) will often be felt in the sutures. Very large veins ramify over the thin scalp, and the fluid often shines through its attenuated coverings.

Of these characters, the position of the eyes is different in external and internal hydrocephalus, inasmuch as the displacement of the base of the skull depends mainly on accumulation in the ventricle; and therefore the eyes are less likely to be driven out, when the fluid is confined in the cavity of the

* Louis, *op. cit.* obs. 19, p. 114; a case in which a piece of bone, six and a half inches in circumference, was removed by the application of numerous crowns of trephine on several occasions; and a "fungous substance" was said to have been removed from the dura mater. The whole description and history, however, seem to show that this was merely a case of caries of the skull, and the fungous substance only the product of inflammation.

† *Lectures on the Diseases of Infancy and Childhood*, lect. ix.

membranes, since in all recorded cases the accumulation in external hydrocephalus has been limited to the vertex of the skull.*

Surgical treatment. If the child be in fair general health, and not obviously beyond hope of relief, the question occurs, whether mechanical means will be of any avail in checking or removing the effusion. I am not aware that any success has attended the use of internal remedies. I have often made patient trial of mercury, and believe it to be quite inert, as far as procuring any reabsorption of the fluid goes. Nor can I say that I have found any benefit from mercurial or other applications to the scalp. Pressure on the skull, or puncture of the fluid collection (paracentesis capitis), are the only means which hold out any rational prospect of benefit; and although I cannot recall any case of success under my own observation, I do not dissuade their use whenever the disease is not congenital, or accompanied by other malformation, or complicated with symptoms of active disease. There seems more prospect of benefit from using these measures simultaneously than separately. In puncture of the skull, a point must be selected away from the middle line, in order to avoid the sinus, and away from any large vein. A very fine trocar should be used, and only a very small quantity (say two ounces) of fluid withdrawn, careful compression of both sides of the skull being maintained meanwhile. If convulsions come on, the instrument should be at once withdrawn. A cap should be in readiness, made of sheet-caoutchouc, perforated with small round holes, to avoid heat of the head, and slightly too small for the head while unstretched; and this should be applied directly on the withdrawal of the canula. If the child's condition is improved, or not made worse, by the first puncture, it can be repeated in a few days, but not in the same place. Convulsions, however, often succeed the operation; and it has seemed to hasten death. Still the disease itself is so miserable and fatal, that any thing which holds out a prospect of relief, and does not entail suffering, may be tried.

Almost every case of chronic hydrocephalus proves fatal, if the effusion is so extensive as to cause obvious increase in the size of the skull. At the same time, a few patients survive to maturity, as the man (Cardinal) whose bust is in most pathological museums, and who lived to the age of 29; and in a few cases the affection disappears by spontaneous cure. In some cases, where, without obvious malformation, there is some defect of intellect or temper, the only post-mortem appearance has been internal hydrocephalus to a slight amount. Such was the case in the body of a youth, otherwise well formed and healthy, who was beaten to death by his schoolmaster a few years ago. The brain was well formed; but the ventricles large, slightly compressing the convolutions, and containing a large quantity of limpid serum.

A case was lately related to the Royal Medical and Chirurgical Society, by Dr. Thompson of Newcastle-on-Tyne, in which a collection of fluid formed after a contusion received by an infant two weeks old, and gradually produced all the symptoms of external hydrocephalus. The head was twice punctured. At the first operation, clear watery fluid was drawn off, and continued to ooze from the puncture for some time. Convulsions occurred ten days after the operation, attributed to the cutting of some teeth. Another puncture, five weeks after the former, proved permanently successful: the fluid drawn off was more milky. Neither specimen seems to have been analysed.†

The Face.

The regional surgery of the face demands but little consideration in this place, since the greater number of its affections have been spoken of in other parts of the work. Thus the operations for remedying the deformities which are so frequent in this part will be found treated of under the head of

* This point was elaborated by Mr. Prescott Hewett in his lectures at the Royal College of Surgeons.

† *Med.-Chir. Proc.* June 28, 1864.

PLASTIC SURGERY; salivary fistula under INJURIES OF THE FACE; and all the various affections of the MOUTH, JAWS, and GUMS under those headings. The tumours situated in the cheek and parotid region, however, have not been elsewhere described; and as they are of frequent occurrence, and of much surgical interest, we must devote a little space to this topic.

The most frequent tumour in the cheek is the common sebaceous cyst, which in male subjects is developed in front of the ear (*i. e.* in the hairy part of the face), only a little less often than it is found in the hairy scalp. Its diagnosis is obvious, and its treatment easy; but when it dips down more deeply than usual, and lies near Steno's duct, care must be taken to keep close to the cyst. These cysts can in this region be removed most readily by slitting them across with the skin; and this plan also involves a more limited incision, which is an important consideration here. The incision should be horizontal, and the knife be kept as much as possible in the horizontal direction, in order not to wound the duct or nerve.

Cysts of other kinds are also occasionally seen.* I have treated one in the substance of the cheek, in a child five years of age, attributed to a blow received in very early infancy, and containing fluid exactly resembling blood. Iodine injection was practised, and I believe successfully; but the patient was lost sight of before the event of the case could be positively affirmed. I have also seen watery cysts in the neighbourhood of the parotid gland; but the most frequent tumour in this part is the *glandular parotid tumour*. This is a firm hard lump, situated generally below and behind the lobe of the ear, but sometimes in front of it, and is probably developed in one of the absorbent glands which lie over the parotid in that situation;† or it is supposed by some authors to be occasionally developed in the fibrous envelope of the gland. It bears a striking analogy to those glandular (adenoid) tumours which lie in the neighbourhood of other glands, such as the mammary and the prostate, and is described by a recent French author as a hypertrophy of the parotid.‡ It grows slowly, displacing the parotid gland, pressing more or less on the parts contained in that gland, and sometimes burying itself deeply behind the ramus of the jaw. Its structure is very firm and solid, consisting usually of well-formed fibrous tissue, mixed with glandular elements, in which portions of cartilage are often found; and it frequently has one or more cysts in its interior. Its continued growth produces deformity, frequently loss of hearing or difficulty of mastication, and it is said sometimes palsy of the features on the affected side; and so its removal is very desirable. But the operation is often attended with unpleasant, and sometimes even dangerous, consequences, from lesion of the large vessels and of the facial nerve; therefore some caution should be exercised, both in giving an opinion on the probable result of the case, and in operating on the tumour. As with tumours in the neck, the main element of safety in these operations is to have a very free access to the surface of the tumour in some position where it can be approached safely, which in the parotid tumour will be at its posterior edge. For this purpose a T-shaped incision will be most convenient, the vertical line passing down the posterior edge of the tumour. The growth will generally be found enclosed in a distinct capsule; and if the

* Short references to several cases of cysts of various kinds situated in the face may be found in Jamain, *Manuel de Pathologie et de Clinique Chir.* vol. ii. p. 42. Care must be taken to distinguish between a watery cyst and a collection of fluid in the expanded duct of the parotid from wound or obstruction of that duct. Cases of this latter affection will be found described by Jarjavay, *Mém. de la Soc. de Chir.* vol. iii. p. 492. It will be recognised by the position of the swelling, its increase in volume during mastication (when possibly some slight escape of saliva may take place through minute openings on the skin of the cheek), and the dryness of that side of the mouth. The treatment consists in reëstablishing the opening into the mouth.

† See the figure by Mascagni of the lymphatic system of the face, reproduced in Gray's *Anatomy*, 3d ed. p. 456.

‡ Bauchet, in *Mém. de la Soc. de Chir.* v. 289.

latter be freely opened, and the knife kept close upon and directed towards the surface of the tumour, the operation is usually completed without accident.* But the position of the facial nerve, the external carotid artery, and the large trunk which forms the commencement of the external jugular vein, must be carefully kept in mind. I have often seen each of these parts wounded; and, indeed, it may be mechanically impossible to remove the tumour without dividing the nerve. If the artery is wounded, it happens generally in the last stage of the dissection, and there is frequently no difficulty in securing it. When the tumour passes into the neck, its removal is of course more hazardous; as also when it dips under the ramus of the lower jaw. If the trunk or a main branch of the facial nerve has been severed, a most unpleasant drawing of the features is the immediate result; and this condition is very likely to remain permanently. It is true that simple wounds of nerves rapidly heal, and often without loss of function; but the division of a nerve in the cavity of a large wound, where the cut ends may not be in contact, or may become separated afterwards by inflammatory products, is another matter.† However, palsy of the nerve may be produced by inflammation occurring in its neighbourhood, without any wound, or with only a slight injury to the nerve itself; and this palsy will be transient. The circumstance will be distinguished by the fact of the palsy not occurring instantaneously after the operation, and being at first incomplete. If the tumour should extend far forward, Steno's duct is endangered, and may be divided, leading to a salivary fistula, which, however, if treated in the usual way, may prove curable.‡

These tumours are sometimes observed to recur; in all probability this is sometimes in consequence of a portion having been left behind at the former operation; but the recurrence of adenoid tumours in other parts§ should make us hesitate to admit that this is the only cause. The most interesting case is the one recorded by Langenbeck.|| Here the original tumour was clearly distinguished, by its difference of appearance, from the substance of the gland in which it was imbedded. After a year it recurred. The extirpation was then difficult, and involved a wound of the facial nerve, and persistent facial paralysis. Five years afterwards the patient presented himself with a tumour beneath the sterno-mastoid, as large as a child's head, which adhered to the periosteum of the inside of the jaw, passed down on to the styloid process, rested on the sheath of the common carotid artery, and had the internal jugular vein imbedded in it. The extirpation of this tumour was nevertheless successfully effected, and even without injury to the vein.

The other tumours of the face derive too few peculiar characters from their anatomical relations to detain us at present. I would, however, just mention a very singular tumour, spoken of by MM. Bérard and Denonvilliers (*Compend. de Chir.* iii. 99), formed apparently by a distension of the frontal sinus, producing intense pain, displacement of the eye, and a large accumulation of gas in the superficial parts of the face communicating with the neck. The patient was under the care of M. Jarjavay, and recovered after the tumour had been laid open and had suppurated.

* A case related by Vanzetti, *Observation de tumeur fibreuse de la parotide*, *Bull. de la Soc. Anat. de Paris*, 1844, p. 40, in which the tumour was of very large size, and passed inside of the ramus of the jaw, will show the importance of recognising and keeping within this capsule. When this is done, large portions can be detached without any cutting; and the capsule is sure to separate the operator from any important structure which may be endangered. See also Liston, *Prac. Surg.* 4th ed. p. 324.

† In a case related by Bauchet, *op. cit.* p. 337, the operator, M. Lenoir, having recognised the two ends of the facial nerve, which he had divided, placed them in contact, and the paralysis was only transient.

‡ Salivary fistula occurred in 3, and facial paralysis in 3, out of 11 such operations related by M. Bauchet.

§ See DISEASES OF THE MAMMA, p. 679.

|| *Archiv f. klin. Chirurgie*, i. 4.

Finally, I ought perhaps to say a few words about those great tumours which sometimes spring from the bones of the face, and produce horrible deformity by driving the eyes out, distorting the features, &c. They have been alluded to above, p. 128, as "hypertrophies of the upper jaw-bones," the name by which Mr. Stanley described them. Some of them are of this nature; others are diffused enchondromata, springing from the base of the skull. In a very remarkable specimen, in St. George's Hospital Museum, described and figured by the writer in *Path. Soc. Trans.* vol. x. p. 250, the tumour almost fills the anterior fossa of the base of the skull, and has pushed both eyeballs completely out of the orbits, besides filling the nasal cavity and projecting on the cheeks. When such tumours have been less extensive, and free from cerebral symptoms, attempts have been made to remove them;* but these have failed, in consequence of the extent of attachment of the tumour to the base of the skull. Very careful examination is therefore necessary before the Surgeon commits himself to any such attempt; and it is only when there is sufficient reason for believing that the tumour has a comparatively narrow attachment, that the attempt holds out much encouragement. If the eyes are widely separated, and pretty equidistant from the middle line; if the parts of the tumour within reach are fixed to the bones of the face; and if ossification or calcification seems to be proceeding extensively in the mass,—the obstacles to the operation will probably be found insuperable; nevertheless, it is quite possible that the removal of the cartilaginous surface of the tumour may at any rate arrest its growth; and in these frightful cases it is justifiable to run considerable risks. The absence of dilatation of the face from outward pressure of the malar or superior maxillary bones is a favourable diagnostic indication, as tending to show that the nasal cavities are alone implicated. But even then the base of the tumour may be so extensive or so remote that its complete removal is impossible.

The opening of the mouth is occasionally much narrowed and displaced. This occurs as a consequence of ulcerative and gangrenous affections of the soft parts, and sometimes also of the bones; from lupus, rodent or canceroid ulcer of the face, mercurial ulceration, cancrum oris, burns, or wounds which have taken on an unhealthy action. The deformity is excessive; nutrition is sometimes seriously impaired from the limitation of the movements of the jaw, as well as the narrowing of the opening of the mouth; and an attempt at cure is imperative. In all such cases much care ought to be taken to ascertain, if possible, the condition of the parts inside the mouth. Sometimes the gums and cheek are incorporated, or the jaws may be partially ankylosed. Frequently large masses of foul deposit exist around the teeth. If the parts within the mouth are forcibly adherent, and the mucous membrane greatly altered from its natural condition and cicatrised, there is not much hope of success from surgical operation; but if the mucous membrane be movable on the skin, an incision may be made outwards from the corner of the opening, a portion of the skin may be removed, leaving the mucous membrane, which is then to be divided, and the mucous flaps stitched to the edges of the skin. In this manner, if primary union be obtained, there is the less risk of the opening recontracting. Or, if this be impossible, two flaps of skin may be drawn down from the face and united to the edges of the incision, with their cutaneous surfaces towards each other. If these will unite, the adhesion of the edges, and the consequent cicatrization of the wound, with reproduction of the deformity, may possibly be obviated. But it must be allowed that the parts are often so diseased and scarred, both around the opening and for a long distance on the cheek, that neither of these plans is feasible. In the only case in which I have had an opportunity of trying this proceeding,† the

* Viz. once by Mr. Morgan of Guy's Hospital, and again by Mr. Moore; the model of the head in the former case is in the Museum of Guy's Hospital.

† The case was reported by Mr. Sercombe, in the *Med.-Chir. Trans.* vol. xxxix. p. 95.

substance around the oral opening was so completely altered in character, that it was impossible to separate mucous membrane from skin; while the parts on the cheek and chin were so changed from their natural condition, that it would have been hopeless to endeavour to transplant skin. Under such circumstances, as also when the parts inside are extensively cicatrised, it would be well to give a patient trial to dilatation by means of conical pads of ivory, or some similar smooth substance, so contrived as to make gradually increasing pressure against the opening.*

Inflammatory affections about the parotid or other salivary glands are of very frequent occurrence; especially the trivial contagious affection so common in children called the mumps, which consists in swelling of and around the parotid, submaxillary, and sublingual glands, accompanied with some pain and stiffness in using the jaw. It is ordinarily confined to one side at first; but is very liable to spread to the other. Generally it is quite devoid of danger, or, in fact, of any importance, and requires no treatment beyond a warm fomentation or poultice, with perhaps some saline diaphoretic. But cases in which the inflammation has been transferred (by metastasis, as the term is) to the testicle have been already referred to (p. 569); and the same thing takes place in the female mamma, though more rarely; while metastasis to the brain appears to have been noticed. These complications must be treated in the same way as similar inflammations excited by other causes.

Inflammation of these parts may also be excited by the use of sialogogue medicines, especially mercury; or inflammation accompanied by salivation may occur spontaneously. In the former case the disuse of the irritant, with the frequent employment of astringent gargles, and the internal administration of tonics with chlorate of potash and nutritious fluid diet, are the measures indicated. Spontaneous inflammation of the salivary glands is generally more rebellious to treatment: the general health and the local condition of the gums should be the first objects of inquiry and attention. If there be much swelling and tenderness about the parotid, leeches may be of service. When the inflammation has become chronic, the local application of iodine, or the careful use of mercurial ointments, is indicated.

These complaints are all of them liable to end in abscess; and such abscesses, bound down by the firm fascia which covers the parotid gland, are both painful in themselves and distressing, from the impediment they offer to mastication. They have been also known to burst into the meatus auditorius, and to burrow about to a great extent in the neck. They should be opened early; but it is desirable, in all affections of the face and its neighbourhood, to avoid too free incisions; and if the opening be made sufficiently early, a mere puncture through the skin, with a tolerably free division of the subcutaneous parts, including the fascia, will suffice. If a more extensive incision be required, the natural foldings of the skin must be studied, and its direction be made to correspond.

Abscesses are occasionally produced by calculi imbedded in the duct of the parotid gland. The existence of such calculi in some cases of ranula has been already noticed, vol. iii. p. 906. Their composition is phosphate of lime, with a little triple phosphate. If such an abscess be allowed to burst externally or be opened on the cheek, a salivary fistula will probably result. Hence it is important to open the abscess and remove the foreign body (which can easily be felt) from the interior of the mouth.

The face is liable to be attacked by epithelial, rodent, and lupous ulceration. The nature of these various forms of disease has been discussed in other essays, and their diagnosis and treatment has been, as far as possible, pointed out. But the interesting question remains for discussion in this place, what resources has operative surgery in the treatment of these affec-

* See the essay on INJURIES OF THE FACE, vol. ii. p. 258. On this subject consult Wernher, *Handbuch der allgemeinen Chirurgie*, vol. iv. p. 18.

tions when they attack the face? Few Surgeons of experience can have been without opportunities of witnessing the frightful condition which is induced by canceroid and rodent ulceration of the face. The features gradually and slowly yield to the progress of the disease; the soft parts are eaten away; the bones crumble, or become necrosed; the nose and mouth, and sometimes the orbit also, fall into one cavity, and yet the patient lives on, though frequently suffering terrible pain; and although presenting a condition of incurable mutilation, which no feelings of humanity can prevent our regarding with some amount of repugnance. The disease is too generally regarded as a hopeless one, and the Surgeon is glad to escape from his patient. Yet, in the case of rodent ulcer almost certainly, and in many of the cases regarded as epithelioma very probably, if the disease were destroyed entirely and in its whole extent, the patient would be restored to good general health, the edges would cicatrise, and the gap in his features could be filled up by some of the many kinds of mask, or false features, which the ingenuity of our dentists and mechanicians has produced. A very remarkable case in this respect, and one which holds out great encouragement to more boldness in operating on such diseases than has hitherto been used, was under the care of Mr. Moore at the Middlesex Hospital, and is published in the *Brit. Med. Journ.* Aug. 23, 1862. The chief points were these: an ulceration with firm base had destroyed the greater part of the contents of the right orbit, the eyelids and skin in the neighbourhood. Mr. Moore excised the disease with the knife as far as possible; but finding portions of it extending farther amongst the bones than he could reach with the knife, he applied chloride of zinc in paste to the raw surface.* In five weeks the entire slough thus formed separated, and left a vast healing surface. The parts removed comprised the nasal bones, the entire circumference of the front of the orbit, a square inch of the roof of the orbit (exposing the dura mater) and the floor of the orbit, opening the antrum, both nostrils and the air-cells of the ethmoid bone. At the present date, two years and a half after the operation, the surface remains perfectly healthy, and the patient is in excellent health. Another, and still more formidable, case of the same nature is at present under the care of the same Surgeon, and is improving under similar treatment.†

The Neck.

The chief points in the regional anatomy of the neck are connected with the arrangement of the cervical fascia. This membrane has an arrangement in the neck somewhat similar to that which prevails in the limbs, although more complicated; that is to say, it consists of a system of long sheaths or tubes, which surround the muscles and the chief vessels, together with the trachea, and which take attachment to the bony framework of the part—viz. to the lower jaw above, the clavicle and ribs below, and the spinal column at the back. As the fascia lata, if traced upwards, will be found continuous with the iliac fascia around the femoral vessels, so the cervical fascia may be traced behind the sternum and ribs, till it becomes continuous with the outer layer of the pericardium. Now, the extensive connexions of this fascia

* The first pain was obviated by the hypodermic injection of morphia.

† Much freedom in operating on these cases of epithelial ulceration is justifiable, even if for no other motive, to relieve the wearing pain which it occasions. A man above eighty years of age came under my care a short time ago, begging for relief from the pain of an extensive epithelial ulcer of the eyelids. He was labouring under disease of the heart, and could not safely be brought under the influence of chloroform, but he had great courage, and submitted to the operation without complaint. I removed the whole of the lower and about half of the upper eyelid, down to the bone, and filled up the gap with a flap from the cheek. This united perfectly. He was freed from his distress, and no return of the disease took place up to the time of his death, which occurred from the heart-disease, in his sleep, about half a year after the operation.

explain how it is that tumours, lying beneath it in the neck, may grow to such a size, may pass down in so many different directions, and may implicate such important parts before they have made enough progress externally to induce the patient to apply for their removal; how spreading affections, such as diffuse inflammation or abscess, may pass down into the cellular tissue of the thorax, and the disease thus be withdrawn from all possibility of successful treatment; and therefore why Surgeons always regard operations conducted below the cervical fascia with apprehension, both on account of their immediate dangers, and their possible complications. The affections which attack the parts superficial to the cervical fascia do not call for much notice here. Sometimes, however, superficial tumours may be met with in this situation, which, either by the negligence of the patient, or the ignorance of those whom he has consulted, have been allowed to grow to a great size. A striking instance of this is the fatty tumour figured in Liston's *Practical Surgery* (4th ed. p. 321), and which was as large as the patient's head.* When above the fascia, these growths, whatever be their size, may be removed with as little risk as tumours of the same size in any other parts. The signs indicative of their being situated over the fascia will be the readiness with which the finger can be placed beneath them and between their base and the larynx, or the sterno-mastoid muscle, their mobility, and the dimpling of the skin when moved over them, which is usually noticed in fatty tumours.

We pass on to consider that peculiar form of watery tumour, or cyst, which is described as *hydrocele of the neck*. This swelling is sometimes superficial to the cervical fascia, but usually more deeply seated; sometimes congenital, at others an affection of later life;† sometimes simply cystic, at others of a more complex anatomy. The first point to be established is the character of the tumour, and the next its situation. Simple watery cysts, or true hydroceles, are such as are destitute of all solid base, and contain frequently a purely watery fluid; at other times, more or less of the constituents of the blood may be found mixed with the fluid (hæmatocele). The cyst is usually single. From this type there are numerous variations: thus, the occurrence of a congenital tumour, consisting of one or two cysts, with a solid basis, is sufficiently common; and the number of the cysts, as well as the quantity of solid matter, may be increased until the whole side of the neck is filled with a solid tumour, in which cysts with various contents are scattered. This latter affection is, I believe, always congenital.‡ As to the situation of the tumour, the most common is below the sterno-mastoid muscle, which is often flattened out and atrophied by the pressure of the cyst, till it resembles a narrow band crossing its wall and projecting into the cavity. But the simple cysts may be found superficial to the fascia. The carotid triangle is a favourite situation for these tumours.

The diagnosis of the affection has been obvious in all the cases which I have seen.§ The only ambiguity which I have met with is, as to whether hardening around the base of a cyst depended on the presence of a solid

* See also a case in *Path. Soc. Trans.* vol. xi. p. 256.

† Gurlt, *Ueber die Cystengeschwülste des Halses*, p. 210, says that very few of the recorded cases have been congenital.

‡ See, on the subject of these compound-cystic tumours of the neck, a paper by Mr. Caesar Hawkins in *Med.-Chir. Trans.* vol. xxii.; one by the author "On congenital tumours," *Lancet*, May 21 and 28, 1864; and see also the section on congenital tumours in the essay on the SURGERY OF CHILDHOOD, p. 828.

§ M. Michaux (*Bull. de l'Acad. Roy. de Méd. de Belgique*, vol. xii., and *Gaz. des Hôp.* No. 36, 1853, pp. 136, 144, 147) relates several cases of hæmatocele of the neck, in some of which the diagnosis was so obscure that nothing but puncture would clear up the difficulty. In most cases the diagnosis from aneurism may easily be made, even if the tumour should have the arterial pulsation, by remarking that though pressure on the carotid below suspends the pulsation of the tumour, it leaves it equally full, tense, and distinctly fluctuating, as also by studying the bruit. See a case reported by Gurlt, *op. cit.* p. 225.

tumour, or was due merely to the pressure of the cyst. The doubt would much influence our prognosis, though perhaps it would not make any difference in the treatment first adopted. I ought also to mention that Von Ammon* describes and figures tumours, apparently of this compound-cystic nature, as congenital enlargements of the thyroid body. I have not seen any which were developed in that organ. The diagnosis would be easily made by watching the effort of swallowing on the position of the tumour, and by tracing, if possible, the muscles connected with the thyroid cartilage and under border of the hyoid bone.

As to the prognosis and treatment of these cases. The simple hydroceles advance somewhat rapidly; they may grow, however, to a large size without making pressure on the deep-seated organs, and treatment may be adopted with much prospect of success.† I have seen in an instance of simple hydrocele a single injection of tincture of iodine followed by complete cure, although the cyst was of large size. The patient was an infant, under Mr. Prescott Hewett's care, and on examining the parts afterwards nothing was to be felt but the hardened remains of the cyst, while the distended skin hung in a loose fold over the clavicle. In other cases, even where some thickening existed at the base of the cyst, I have seen iodine as completely, though less rapidly, successful. But where there is solid matter as well as cysts iodine does not usually succeed, and then it may be justifiable to resort to setons, though the measure is not without danger,‡ or to make a free incision into the cyst or cysts, and endeavour to procure their obliteration by the granulating process, or to cut a large piece of the cyst out, or even to destroy the whole mass by the application of arrows of caustic, as recommended by Maisonneuve (see vol. iii. p. 43). But in cases which are suitable for removal, extirpation, though of course it presents more immediate risks, seems ultimately the less dangerous course. On this subject the reader is referred to what is said below on the general question of removing tumours of the neck.§

* *Die angeborenen chirurgischen Krankheiten*, tab. xiii. figs. 1, 2, 3; tab. xxiii. figs. 7 to 11 incl.

† A case is reported by Wernher (*Die angeborenen Cysten-Hydrone*, Giessen, 1843, p. 3), where openings formed spontaneously in the tumour, the fluid oozed away, and a natural cure resulted. Another is recorded by Mr. B. Phillips, *Med.-Chir. Trans.* vol. xxv. p. 299.

‡ Thus, in Dr. Storch's case (*Journ. f. Kinderkrankheiten*, vol. xxxvii.), the seton was used with a fatal result. The dangers of setons in cases of cysts of the thyroid body are well known. They are perhaps less dangerous in other deep-seated tumours of the neck; but they should never be used without grave deliberation. I have seen the use of a seton in a case of this sort fatal in a week to a person otherwise in good health.

§ It was in all probability to such tumours as these that Mr. Liston refers in the following passage: "In the lower triangular space of the neck, though not so frequently as in the upper one, all sorts of strange tumours are encountered. Many watery tumours are met with here, some of them in young patients, and congenital; others appearing at a later period. The smaller ones may be opened and dressed from the bottom, or treated with escharotics. Some of them may be punctured and treated by seton; others have besides a mass of solid material attached, and then extirpation, if practicable, is to be preferred. A curious case occurred in my hospital practice lately: a middle-aged healthy man applied on account of a soft elastic lobulated mass, filling completely the space above the right clavicle. It was taken to be a fatty tumour, and was cut upon accordingly. The first incision gave vent to an ounce or more of serum. The dissection was pursued, and six or eight other distinct sacs adherent to each other were gradually exposed and extracted. The space of the neck was completely laid bare, the nerves could be seen, and the subclavian artery pulsated at the bottom of the wound. The internal jugular vein, for two inches, was exposed; and, for the first time, I was cognisant of air rushing into a branch entering into the root of this vessel. So complete was the exposure of parts that the carotid and subclavian arteries could have been tied without further dissection. All went well." Liston, *Practical Surgery*, 4th ed. p. 330.

Deep sebaceous cysts. The nature of the tumours which are so often found in the deeper parts of the neck, that is to say, lying in or below the deep cervical fascia, is a matter of great importance in their surgical treatment. Langenbeck* has pointed out that dermoid cysts in this region, contrary to what takes place in other parts of the body, are frequently found below the deep fascia, and not unfrequently adhere to the sheath of the cervical vessels, or are possibly developed in the substance of the sheath.† As to diagnosis from cysts of a different kind, Langenbeck points out that in all the recorded instances the cysts have been situated in the neighbourhood of the larynx, or of the great vessels of the neck, above the omohyoid muscle; that in the latter situation they are perceptible from the mouth, and the peculiar fluctuation of the pulpy fluid they contain may be felt by placing one finger in the mouth and another on the skin; that the swelling is of a round or oval form, and perfectly smooth; that they may often be made to share the pulsation of the carotid by drawing the head strongly backwards and to the opposite side; and that they are, sometimes at any rate, movable from side to side, but not upwards and downwards. It must, however, be allowed that these signs are hardly sufficient to distinguish them from other cysts in all cases without a puncture. After having tried all the usual plans of treatment, and after having succeeded in curing one of these tumours by maintaining suppuration in it for a year and a half, Langenbeck has found such measures so uncertain and so tedious, that he prefers extirpation with all its risks.

The most ordinary of all surgical affections of the neck is the *enlargement of the glands*, which is so very common in scrofulous persons, especially children. On this head reference is to be made to Mr. Moore's essay on *DISEASES OF THE ABSORBENT SYSTEM*, vol. iii. p. 271; and to Mr. Savory's on *SCROFULA*, vol. i. p. 350. But I would here call attention to a point of some practical importance, noticed by Prof. Miller.‡ He points out that scrofulous enlargement of these glands "must be carefully distinguished from the syphilitic glandular affection, characterised by implication of the whole chain of lymphatics on both sides of the neck, along the anterior margin of the trapezius The glands affected [with syphilitic disease] are painless, about the size of hazel-nuts, indurated, and never suppurate. They become affected in this manner before any eruptions make their appearance, and continue sometimes long after any other constitutional symptoms." He regards this condition as almost pathognomonic of constitutional syphilis. He also describes another form of glandular enlargement usually on one side of the neck, of a stony hardness, and generally involving the whole lymphatic chain. The hardness closely resembles scirrhus, but has no real connexion with the cancerous cachexia. It is due to anæmia, and is sometimes conjoined with exophthalmic goître.

Other glandular affections in the neck are occasionally met with, though less commonly than the above. Thus, in the 16th vol. of the *Mémoires de l'Acad. Nat. de Médecine*, is a paper by Larrey jun. on a form of glandular enlargement from chronic inflammation, which he has often met with among the younger soldiers of the French army, and which he refers neither to syphilis, scrofula, nor local irritation (unless it be excited in some cases by stomatitis, the result of the abuse of tobacco), but rather to the moral and material depressing causes incident to the change from the civil to military life.

A peculiar form of enlargement of the cervical glands is described by

* *Archiv f. klin. Chir.* vol. i. part 1, *Beiträge zur chirurgischen Pathologie der Venen*, one of the most interesting and important treatises in the whole range of surgical literature.

† The published instances of this disease before the date of Langenbeck's paper will be found in Gurlt, op. cit. chap. vi. cases 3, 5, 6, pp. 266, 267.

‡ *System of Surgery*, 1864, p. 844.

Dr. Ogle, in *Path. Soc. Trans.* vol. xi. p. 255, in which they formed a chain of large rounded tumours, which were successfully removed by operation. The nature of the affection remains obscure.

These glandular affections also may implicate the sheath of the great vessels of the neck. Thus in Larrey's case, mentioned below, p. 968, and in several of those referred to by Langenbeck, enlarged glands were found in the substance of the sheath itself; and on their removal, the carotid artery or the jugular vein, as the case might be, but more commonly the latter, was left cleanly dissected out, and quite deprived of all covering from its sheath. Langenbeck cautions his readers not to be deceived into relying too much on the mobility of such tumours as a certain mark of their superficial position, since this may really be only the movement of one part of the tumour on another, and the deeper parts of the mass may be lying on, or between, or even behind, the vessels. He does not on that account shrink from advising the removal of such tumours when other means fail; but it is plain how great the dangers and difficulties of the operation may prove. It should, therefore, never be performed unless the glands affected are limited in number, unless the symptoms of the disease are really productive of serious distress, and unless a very patient trial has been given to topical and general remedies; and the Surgeon ought to enter on the operation with a full knowledge of the difficulties he may encounter, and the precautions which are to be taken to meet them.

Epithelial cancer also may affect the deep parts of the neck and implicate the sheath of the vessels. It may be known by its occurring later in life than the previously named affections; by its less defined outline; the strings or processes which often project from it; the pain which it produces; its tendency to spread towards the pharynx and larynx, thus producing dysphagia and dyspnoea; by the more extensive interference with the circulation which it causes, and in advanced cases by the enlargement of the glands below the tumour. The innocent tumours previously described, though they may compress the vessels, do not infiltrate them; but with these tumours the vessels and nerves may be absolutely incorporated. If, therefore, they are to be operated on, it should not be without the most careful and repeated examination.

The diagnosis of tumours at the root of the neck, in fact in all parts of the region, but particularly at the root, near the pleura, must be carefully made from the *abscesses* which are so frequent in this situation, and which have been spoken of in the essay on *ABSCCESS*, vol. i. p. 148. Such abscesses do not fluctuate at first, in consequence of their deep position and their being bound down by the fascia; but they are seldom, if ever, found without some sign of inflammation, besides which the diseases on which they often depend will be present, and will materially assist diagnosis. These are scrofulous affections of the glands, disease of the vertebræ, inflammation of the pleura, and it is said disease of the arteries; other abscesses, however, having no visible exciting cause, are not uncommon. The rate of progress of the disease, its much more acute symptoms, and the ill-defined extent of the swelling, usually distinguish abscess from tumour. Hydatid cysts have also been found in this as in most other regions. Mr. Dixon's case is well known;* and others, both within the thyroid body and external to it, will be found in Gurlt's work. The proper treatment will be to lay open the cyst, take away all the hydatids, and allow the cavity to fill up by suppuration.

The *sterno-mastoid muscle* may be occasionally found indurated, and forming a sort of tumour, which extends up a great part or the whole of the neck. This affection has been already referred to in the essay on *DISEASES OF MUSCLES*, vol. iii. p. 528, and I only mention it here with reference to

* *Med.-Chir. Trans.* vol. xxxiv.

diagnosis. It is most common in children. Indeed Mr. Bryant, in his recently published *Lectures on Surgical Diseases of Children* (p. 142), speaks of it as though it were peculiar to early life. I have seen cases in the out-patient room of the Hospital for Sick Children, in one at least of which I thought the affection was syphilitic; but in others no such taint has existed. It must be carefully distinguished from an enlargement formed by strumous glands, and there will be no difficulty in doing so, if the Surgeon will bear in mind the existence of the affection. The obvious test is that the swelling in one case is within the sterno-mastoid, and its mobility varies with the contracted and relaxed state of the muscle; while in the other case the swelling is behind the sterno-mastoid, and is unaffected by its action. The muscular affection is a very curable one in childhood, and very often perhaps would disappear spontaneously; if not, heat or gentle counter-irritation, with attention to the general health, will cure it; while the glandular affection, unless owning a well-marked local cause, is a very rebellious one, and may prove quite incurable.

Enlarged bursæ are found in the anterior part of the neck, although rarely. At least the cases of this disease which are on record are few; but this, as Gurlt observes,* may proceed from the triviality of the affection as probably as from its rarity. These bursæ may be situated either in front of the pomum Adami, between the posterior surface of the hyoid bone and the thyroid cartilage, or between the muscles of the tongue. The two former bursæ are found in the normal state, although that in front of the thyroid cartilage does not always exist. The bursa among the muscles of the tongue is an accidental formation, and has been spoken of in the essay on DISEASES OF THE TONGUE (vol. iii. p. 907). The first kind (the ante-thyroid bursa) forms a rounded fluctuating superficial swelling in front of the larynx in the middle line, reaching downwards towards, and in a case recorded by Larrey† even prolonged to, the sternum by a fistulous channel. The second (the supra-thyroid bursa) is of smaller size, and lies on one side of the middle line, covered by the thyro-hyoid muscle. Both of course follow the larynx in its movements during deglutition, and so far resemble the cysts of the thyroid body; from which, however, there can be but little practical difficulty in distinguishing them. If there be any doubt about the diagnosis, the character of the fluid evacuated by puncture will settle the point. Instead of the disintegrated remains of blood which are found in the thyroid cysts, these contain the jelly-like fluid which characterises bursal tumours and ganglions in other parts of the body. The treatment should be the same, viz. puncture and blisters, or injection of iodine.

Removal of tumours of the neck. Tumours lying below the deep fascia of the neck are always the source of anxiety, and often of great embarrassment, in their removal; and this becomes more and more the case as the tumour passes further forward. When the mass lies beneath the sterno-mastoid muscle, the Surgeon must always consider carefully, before he commences the operation, whether he is likely to be able to bring it to a termination,—that is to say, whether he has a fair prospect of removing the whole growth; for unless such a prospect exists, the operation is unjustifiable. The main points in these operations are so well detailed in an account by Mr. Spence of the removal of an enormous enchondroma from the neck and face, that I cannot do better than to refer the reader to his most interesting paper in the *Dublin Quarterly Journal of Medical Science*, Nov. 1863. The operation was, as far as I know, unique, the tumour extending from the zygoma nearly to the clavicle, and from the spine to the cricoid cartilage, and weighing more than 7 lb.

* Op. cit. p. 39. A complete collection of the recorded cases of each variety of bursal tumour may be found here.

† *Gaz. des Hôp.* 1853, pp. 212, 225.

In summing up the chief points of this very remarkable case, Mr. Spence dwells upon the following as the main considerations to decide the practicability of removing a tumour from beneath the sterno-mastoid muscle: 1. Is the growth innocent or malignant? If malignant, the important structures near which it lies will very probably be incorporated with it, and the tumour could perhaps only be removed by doing fatal damage to them: if innocent, however closely it may press on these structures, it will be enclosed in its own capsule; and by keeping the edge of the knife or scissors close upon the tumour, the main vessels and nerves will in all probability be avoided. 2. The state of the circulation: engorgement of the veins on either side,^{*} or marked alteration of the arterial supply in the affected side, would give reason to fear that the growth is extensively connected with the internal jugular vein or the carotid artery respectively. And finally, the impairment of the functions of respiration or deglutition, or the existence of laryngeal irritation, would point to implication of the vagus nerve, the phrenic or the laryngeal nerves, or to pressure on the œsophagus or air-tube. Careful exploration from the mouth, and an examination of the mobility of the tumour in various positions of the head, should not be neglected.

In the operation for removing such tumours, the main points are to have a very free access to the tumour, and for this purpose to dissect large flaps off it by crucial incisions, to define its surface clearly and for a large extent in some position where its relations are free from danger (usually its posterior border), and to work gradually from this point by stretching the tumour so as to make plain its cellular connexions, and then cautiously dividing the latter with the scalpel or blunt-pointed scissors directed *towards* the tumour.[†] In Mr. Spence's case the extent of the growth was so great that the whole sterno-mastoid was of necessity divided; and then the plan which Mr. Spence adopted, of exposing the whole front of the tumour and cutting across the muscle at once, is no doubt the best, since it gives as full a view as possible of the whole neck, and enables the assistant (whose duties in these operations are almost as important as those of the operator) to compress the main vessels and to push them back, by insinuating his fingers in the track of the dissector. But in the case of a tumour situated beneath the sterno-mastoid of much less extent than in Mr. Spence's patient, although still of considerable size (since the dissection commenced above, over the mastoid process, and terminated below by exposing a part of the brachial plexus, and was continued backwards to the transverse processes of the cervical vertebræ), I was able to remove the tumour without cutting through the whole sterno-mastoid;[‡] and I believe that it is better to retain the sternal portion of the muscle entire, if possible, whenever the growth does not project beyond its anterior edge. This proceeding is more dangerous than that adopted by Mr. Spence, since the part of the growth lying near the carotid sheath has to be dug out, as it were, from beneath the muscle almost in the dark; but, on the other hand, the preservation of a part of the muscle is a safeguard against deformity. When the edge of the tumour has been fairly and cleanly exposed, the operator should next endeavour to clear its lower part, whenever there is a doubt as

* Langenbeck points out that in tumours which involve the sheath of the vessels engorgement of the veins of the face is rarely absent. In one case he observed this venous engorgement to be on the opposite side to the tumour. This he attributed to the fact that the tumour compressed the carotid artery as well as the jugular vein, as proved by the weakness of the pulse in the temporal artery.

† Dieffenbach (*Op. Chir.* vol. ii. pp. 327 et sqq.) recommends, in operations on large tumours, to use two separate incisions, both longitudinal, one running over the front of the tumour, more or less parallel to the anterior edge of the sterno-mastoid, the other behind that muscle. He used to dissect the tumour free from its spinal attachments from the posterior incision, and to free it from the vessels, &c. by dissecting from the anterior one. His main object seems to have been to avoid the division of the sterno-mastoid; but a sufficient number of cases are now on record to prove that this does not do any material harm.

‡ *Lancet*, 1864, vol. i. p. 576.

to its relations to the great vessels of the neck, in order to expose their sheath and render himself master of the circulation through them. Cases quoted below will show that both the common carotid and internal jugular vein may be tied without compromising the success of the operation; and even the division of the pneumo-gastric nerve also has been followed by recovery. But every possible effort should be made to remove the tumour without dividing any of these structures, particularly the last. The vein is the most likely to be implicated. Innocent tumours, even when they occupy the sheath of the artery, do not generally surround it. Langenbeck has shown that the jugular vein may be dissected out for some inches from the substance of a tumour, the vessel being entirely denuded and its whole sheath removed, yet no ill consequences follow.* If the descendens noni nerve be in the way, as in Gibson's case, it may be divided. In the more delicate part of the dissection blunt-pointed scissors should be used, and the fingers should be employed to sever the adhesions of the tumour as much as possible, and as a guide or director to the cutting instrument when the wound is too deep to allow of a clear sight of the parts. Compression of the internal jugular below the tumour will be a safeguard against death from the entrance of air into the heart.

Such operations as these appear to have been rarely undertaken,† Mr. Spence's researches having only discovered four published cases of the kind by British Surgeons‡ previous to the publication of his own: but smaller tumours, mostly of an enchondromatous or solid fibrous nature, lying in the anterior triangle of the neck, or over the parotid gland, are very common, and the operations for their removal must be managed on the same general principles, viz. to open the capsule of the tumour (when it has one), expose its surface freely in some safe part, and then stretch and carefully sever the cellular adhesions of the other parts. In doing this the operator must take all possible precautions not to permit the entrance of air into the veins, and all large veins should be tied before they are cut.

Foreign Surgeons have been somewhat more bold in their treatment of these formidable tumours. Langenbeck's brilliant operations have been referred to; and his paper should be studied by every Surgeon entering on this department of operative practice. In connexion with this question the reader may also be referred to the paper by Larrey in the 16th volume of the *Memoirs of the French Academy of Medicine*, in which the propriety and the method of performing these operations is discussed at length. M. Larrey regards such operations as being the most uniformly successful in the whole range of surgical practice, if only the risks of the operation itself are got over without disaster.§ Several interesting cases are quoted; especially one in which his father, the first Baron Larrey, removed a mass of diseased glands from the anterior triangle, one of which was imbedded in the sheath of the vessels; and another case in which M. Labat successfully extirpated a tumour

* *Archiv f. klin. Chir.* i. 4, 14.

† Some Surgeons are indeed formally opposed to such endeavours. Thus Prof. Miller says that "tumours beneath the sterno-mastoid do not admit of operative interference." *A System of Surgery*, 1864, p. 846.

‡ Mr. Atkinson of York relates, in the *Med. and Phys. Journ.* vol. xxx. p. 353, a case, the physiognomy of which, as given in the drawing, is something like that of Mr. Spence; but the account is obscure, and it is not said whether the tumour lay above or below the sterno-mastoid. This tumour weighed 3 lbs. 9 ozs., and the carotid artery and jugular vein were exposed in its removal. The operation was successful. Mr. George Bell has also put on record, in the *Journal of Medical Sciences* (Edinburgh, vol. i. 1826, p. 61), an operation for the removal of a tumour weighing about 4 lbs. "from the muscular fascia of the neck." This tumour lay above the sterno-mastoid, but dipped down, so that the common carotid artery was exposed in removing it. It stretched from the mastoid process to the clavicle, and seems to have been of a malignant nature, as it recurred a few months afterwards.

§ Dieffenbach also says: "Eine grosse Anzahl Operationen dieser Art, welche ich gemacht habe, sind in keinem einzigen Falle von einem tödtlichen Ausgange begleitet gewesen, und die Heilung erfolgte gewöhnlich ungemein rasch." *Op. Chir.* ii. 322.

extending from the mastoid process to the clavicle, and lying altogether beneath the sterno-mastoid muscle, which was divided across in order to expose it. The carotid artery and internal jugular vein had to be tied, and the pneumo-gastric nerve divided.*

The Axilla.

There are a few particulars with reference to abscess in the axilla to which it may perhaps be worth while to give a little attention. Superficial abscesses, indeed, have no characters in this region to distinguish them from those of other parts of the body; but deep abscesses, *i.e.* those situated in the cavity of the axilla, internal to its walls, constitute a grave malady. Cases are on record where such abscesses have burrowed beneath the muscular walls, into the neck, the back, and even the thoracic cavity. Their causes are various. Some depend on simple sprains or contusions, or occur without visible cause; others on lymphatic inflammation; others on caries of the bones of the thorax or of the shoulder; or even, it is said, on empyema or vomica.† The symptoms of the spontaneous abscess will usually be more acute than those of the symptomatic; but the only reliable diagnostic sign is a thorough examination by means of the probe, under chloroform if possible.

It is of great importance in acute abscess of the axilla to procure a ready and free escape for the pus; since if the opening is small, and the abscess is allowed to get into a chronic condition, it is very liable to fall into the condition of a sinus, which is then kept from healing by the action of the muscles. Therefore, if the abscess is seen before opening, a free and large incision should be made, care being taken to keep the edge of the knife towards the thorax, in order to avoid the large branches of the axillary vessels and nerves which lie towards the humerus. If the abscess be in a chronic condition, and no evidence of diseased bone be detected, the treatment is not easy. If the arm be kept at perfect rest, and the patient be well nourished and fattened, the abscess is most likely to fill up, but it will be at the risk of some loss of motion from cicatrisation and adhesion. This seems, on the whole, the best course; for laying open the whole cavity may do more harm than it is meant to obviate. Sinuses must be treated in the usual manner by stimulating injections, setons, or drainage-tubes, with rest. If adhesions or cicatrices have formed, their subcutaneous division will be indicated; and should much skin have perished, it may be thought right to free the cicatrix from the sound skin in its whole extent, and cover it with a transplanted flap.

Tumours occupying the axillary space, like those developed in other situations where large loose areolar intervals exist, are liable to grow to a very large size before they produce so much distress as to oblige the patient to request relief from a Surgeon. In examining such a tumour two main questions present themselves: first, whether it is innocent or malignant; second, whether, if innocent, its relations are such as to permit of its removal. It is true that even in the case of a tumour judged to be malignant, if it could be very clearly separated from the periosteum of the humerus, it might be proposed to excise it; but in most cases of cancer, amputation would be the preferable course, if any operation were admissible. Nothing need be said here about the diagnosis of innocent from malignant disease, this being the same in the axilla as in other parts. We pass on to the question of the relations of the tumour. Superficial tumours are decidedly rare in this region. Notwithstanding the hairy condition of the integument, sebaceous tumours are

* In Gibson's case (*Am. Jour. Med. Sc.* vol. xiii. p. 305) the tumour was successfully removed from beneath the sterno-mastoid after the carotid artery and jugular vein had been tied and divided. The descending noni nerve was cut, but the pneumo-gastric was dissected out of the mass. The disease was malignant, and recurred; yet it was enveloped by a very firm and distinct capsule.

† Nélaton, *Path. Chir.* vol. v. p. 875.

hardly ever met with. I do not remember to have ever seen one removed from the axilla. The tumours which lie below or in the fascia are of course less movable than those in the subcutaneous areolar tissue. If the mobility be extremely limited, this may be due either to their attachment to the bone, or to their being connected with the sheath of the vessels; the former tumours will be almost immovable, and there will probably be no interference with the circulation; the latter will enjoy somewhat more movement, and the circulation will be more or less impeded. If the venous congestion and œdema be well marked, while the pulse is unaffected, there is direct evidence of pressure on the vein; while if the pulse be also weakened, the tumour probably envelops and compresses both vessels. Its relations to the nerves will generally be determined by the occurrence of twitching, "pins and needles," or numbness. Tumours adherent, even over a great extent, to the sheath of the axillary vessels, may be removed with success by a daring operator, as Langenbeck's experience shows; and even if it were necessary to tie both of the vessels, it would be better to run that risk than to sacrifice the arm: but when the nerves are also involved, the case becomes almost desperate, especially as the most important of the nerves—the median—will be in all probability the most deeply implicated.

Exostoses and other tumours springing from the upper end of the humerus may project into the axilla, and may come into more or less close relation with the vessels and nerves. Thus in the case of a lad recently under my care at St. George's Hospital, a large exostosis, lapping round a great part of the humerus, raised up the artery for a considerable extent. But there is little risk of injury to the main vessels in operating on these cases, since the muscles which separate the bone from the artery can hardly have been atrophied, unless the tumour has attained most unusual proportions. The greater danger is to the circumflex or musculo-spiral nerve, as the case may be. In my case the tumour was so extensive as to trench closely on the position of both of them; but as there were no symptoms of pressure on either, I felt confident that it might be removed without injury; as turned out to be the case. Softer tumours implicating the periosteum of the humerus are always to be looked on with suspicion, since many of them are malignant. But if any doubt exists on this point, the minor operation of excision of the tumour and head of the bone should, no doubt, be resorted to. Mr. Fergusson, in his recent lectures at the College of Surgeons, gave two cases in contrast with each other strikingly illustrative of the advantages of the course recommended.* In one, which was under Mr. Syme's care, that Surgeon removed the head of the humerus with the tumour in 1860. A year afterwards, the disease recurred in the scapula; and in Nov. 1862 the scapula and a portion of the clavicle were removed with perfect success, leaving the patient with a useful arm.† In the other case, the arm had been amputated at the shoulder-joint before the patient came under Mr. Fergusson's care, who was obliged, by the recurrence of the disease, to remove the scapula. A case under Mr. Hutchinson's care‡ shows that, even in malignant tumour of the humerus, its removal by the operation of excision may be followed by the union of the wound, but does not give much encouragement for the practice, since the patient's life does not seem to have been prolonged by it. It is right, however, to add that the operation was performed by Mr. Hutchinson only after amputation had been refused by the patient.

The removal of enlarged glands from the axilla is generally a very simple matter when performed, as it usually is, as part of the operation for scirrhus of the breast; since the glands affected lie near the pectoral muscle, away from the large vessels. The extirpation of strumous glands is a measure of doubtful prudence;§ and yet if there be no other indication of the strumous

* *Lancet*, June 18, 1864, p. 693.

† *Path. Soc. Trans.* vol. viii. p. 346.

‡ Syme on Excision of the Scapula, 1864, p. 22.

§ See the essay on SCROFULA, vol. i. p. 353.

cachexia, and the tumour is productive of much inconvenience, such operations are sometimes undertaken. I once performed such an operation in a child, and ascertained that the patient remained in good health and free from any other manifestation of struma for at least a year, after which time I lost sight of her. An operation of a similar kind is reported in the *Lancet*, 1850, vol. ii. p. 22, as having been performed by Mr. Lawrence. But if the Surgeon determine on this proceeding, he must not deceive himself as to its probable difficulties and dangers. In loose cellular spaces, as the axilla and the neck, besides the glands which are perceptible before the operation, there are sure to be others more deeply situated which are only perceived after the removal of the first. This has been the case in all such operations as I have witnessed. It was so in the instance referred to under Mr. Lawrence's care, as well as in my own case, and in two such operations which I have witnessed in the neck. In my case the axillary artery was wounded,—I believe inevitably. In one of the cases in the neck to which I refer a considerable mass of disease was left behind. In Mr. Lawrence's case the difficulties and embarrassments seem to have been great, and would have been very disagreeable any where except in hospital practice, where plentiful resources and assistants are always at hand. Again, in most of these cases (as in three of the above four) the glands have been found to be in a state of suppuration; and it must remain doubtful whether nature would not have accomplished the removal of the strumous tubercle in this way as completely as the Surgeon. Therefore such measures should only be resorted to after the most mature consideration; and every thing should be at hand which is necessary for a prolonged and difficult dissection among large vessels and nerves.

Langenbeck, in the paper above referred to (page 964), has dwelt upon the frequency with which the tumours, glandular and others, developed in the axilla are found attached to the sheath of the large vessels, and on the best means for extirpating them. That innocent tumours may be removed with success, whatever be their size and however extensive their connexions, is proved by the case related by Langenbeck,* in which he removed a portion of the clavicle affected by a tumour dipping deeply in between the jugular and subclavian veins, and affecting the scalenus anticus muscle, which had to be divided.

Langenbeck recommends that the anterior surface of the tumour be freely exposed, the muscles being divided as far as may be necessary. In one of his successful cases, both pectoral muscles, the deltoid, and a portion of the coraco-brachialis were divided. The tumour is then to be exposed by a free division of its capsule, and the vessels are to be sought for above, where they enter into the tumour. This course he prefers to the opposite plan of exposing the artery and vein at the lower part, for similar reasons as in the neck (see pages 967, 8). The sheath of the vessels, if infiltrated by the disease, must be carefully divided and stripped from the vessels, which should only be tied in the last resort. If the great nerves be implicated in the tumour, so that they cannot be cleared away from it, amputation will become necessary. I recommend a very careful study of Langenbeck's cases to any one who intends to perform one of these operations. A good idea of the probable relations of the tumour will be found by noticing the presence or absence of pricking sensations down the course of the nerves, or loss of their functions, of cedema and venous engorgement, and of alteration of the pulse. In cartilaginous or hard fibrous tumours, processes may project, deep in the axilla, among the vessels and nerves, or may run under the clavicle and approach the subclavian vessels and the pleura, and much add to the embarrassments and dangers of the proceeding. This is still more the case when the tumour originating in the neck has passed down into the axilla, as in Langenbeck's case, referred to above, in which the pleura seems to have

* I mean with success so far that no fatal injury was done to the parts. The patient died of the after consequences of the operation.

been freely exposed, though not opened; and the patient afterwards died of pleurisy. In very extensive tumours, the possible necessity of amputation must be kept in view, and the incision so directed as to preserve flaps to cover the bones, when necessary.

The Thorax.

The diseases of the thoracic viscera being the exclusive province of the physician, and its injuries having been treated of in our second volume, together with the surgical operations practised upon the pleura, no observations on its regional surgery are required here, except a few lines on the subject of abscesses in the thoracic parietes. Such abscesses may arise spontaneously as the result of acute or chronic inflammation, or may be symptomatic of disease of the bones. Diffuse inflammation is the most common cause of the first kind of abscess. It is a serious affection, being often productive of much distress by its local action, as well as testifying to the existence of a grave constitutional malady. Nélaton* speaks of a case in which the dyspnoea was so great as to lead to the erroneous diagnosis of visceral inflammation; an error the more likely to be committed since the inflamed condition of the integuments forbids physical examination. Besides, visceral inflammation may ensue, since the inflammation tends to spread inwards, and if unchecked leads to the formation of abscesses which may extend beyond the walls of the thorax, and make their way into its interior. Active treatment is therefore necessary. If the case is seen before abscess is formed, free incisions must be made, and the other means adopted which have been prescribed in the essay on ERYSIPELAS for the treatment of diffuse cellular inflammation. If abscess have already formed, it must be opened without delay. The constitutional treatment must be guided by the general symptoms, and by the presence or absence of pleuritic complication,—a fact which can only be inferred from the symptoms, if the condition of the parietes forbids direct examination.

Chronic abscess of the chest, unconnected with diseases of the bones, appears generally to take place in strumous subjects, and often in those who are suffering from and predisposed to phthisis. The treatment is the same as in other cases of strumous abscess. Many of those cases which are described in books as abscess pushing the pleura inwards, thickening it, and encroaching on the cavity of the chest, may very likely have been cases of limited empyema; at any rate they could hardly be distinguished from the latter except by the history, often an obscure guide in a chronic complaint. The treatment would consist in laying them open; and if this does not suffice, in providing a counter-opening, and keeping them empty by means of a drainage-tube. In some cases of empyema treated at the Hospital for Sick Children, much benefit has seemed to be derived from a counter-opening, and the injection of iodine; and the same benefit might be more confidently expected in chronic abscess not connected with the pleural cavity, without the dangers which must be allowed to accompany the iodine injection in empyema.† It is not, however, always easy to know whether a small opening may not exist into the pleura, or even the tissue of the lung. An open abscess, whose wall is in contact with the pleura, will follow its movements. Hence in inspiration its wall will be drawn inwards, and its cavity filled with air, which will be ejected in forced expiration.

Most abscesses, however, in the walls of the thorax are symptomatic of disease of the ribs or sternum. The disease is generally caries, though necrosis is sometimes met with; and in some cases, at any rate, it is clearly

* *Path. Chir.* vol. iii. p. 497.

† In one case at the Hospital for Sick Children, iodine injection had been used several times with benefit, when suddenly one day the child coughed up a quantity of the injection. This was followed by very severe bronchitis. The same accident happened to a child under my care at St. George's Hospital; but was not followed by any alarming symptoms.

traced to an injury—usually fracture of the sternum, or separation of its first joint. Thus Nélaton (*loc. cit.*) quotes from J. L. Petit and from Stalpart Van der Weil cases in which after gunshot contusion, and after a sword-thrust, abscess formed on both surfaces (as it seems) of the sternum; and in which, after cutting down on the front of that bone, the Surgeon perforated it with the trephine, and evacuated the matter from the anterior mediastinum. But what the indications for this proceeding were, the accounts appear too meagre to inform us. When, as is more usual, the abscess proceeds from caries of the rib, it appears better not to be too active. The partial resections of the ribs which are spoken of in foreign works on surgery, and which have been chiefly practised in Germany, do not seem very promising operations, while they are by no means free from difficulty and danger. The indications for attempting the removal of a portion of carious rib would be, if it were evidently setting up pleuritic irritation, or if it concealed and shielded a sequestrum on the inside of the bone, which could not otherwise be extracted. In accident, the indications for excision are, if the fractured portion conceals a wounded vessel or a traumatic aneurism. If the whole depth of the bone be not diseased, the Surgeon would of course desire to avoid wounding the intercostal artery, the bleeding from which is often troublesome. In such cases it would be sufficient to detach the muscles from the upper border of the bone, and carefully chisel away the diseased portion. But if the entire thickness of the bone is to be removed, a small incision must first be carefully made through the muscular parietes, and extended on the director as far as may be necessary to separate the muscles from both edges of the rib to the whole length which it is proposed to remove. Then the internal surface of the bone must be freed from the pleura with the handle of the knife, or some more appropriate flat smooth instrument, and the section made with a Hey's saw.*

Nélaton describes, after Boyer, an operation for the removal of diseased parts of the sternum, in order to evacuate matter confined in the mediastinum, and to remove the source of such suppuration; but he does not say that the operation has been practised in modern times.† If a Surgeon had made up his mind to make trial of the operation, he would need no very precise directions for its performance; as it consists merely in exposing very freely the surface of the bone, and applying the trephine on all the part which appears diseased; but it seems a doubtful and very hazardous measure, and could only be justified by the presence of severe dyspnoea, for which no cause except the disease of the sternum could be discovered. In Heyfelder's work (p. 308) will be found a notice of twelve cases in which this operation has been performed in modern times, and only one of which is said to have died from the operation. But real evidence of success seems wanting in the majority of these cases.

The Abdomen.

Very little of importance has been left for our consideration in this place as to the regional surgery of the abdomen, except abdominal tumours, since its injuries and the surgical diseases of all the viscera, digestive, urinary, and generative, have been described in separate essays. The first consideration in determining on the surgical treatment of a tumour of the abdomen, is whether it lies above or below the muscular expansion. It is possible that tumours may also form between the muscles, but the circumstance does not seem to have been put on record. Superficial tumours of the abdomen are usually fatty. Their superficial situation is recognised by the ease with which

* As to the statistics of this operation, Heyfelder says that out of thirty-seven cases of which he has accurate accounts, eight died; the rest recovered, and very speedily too. *Operationslehre und Statistik der Resectionen*, 1861, p. 303.

† This operation has the distinction of being one of the most ancient surgical operations, and was performed by Galen.

they move on the deeper parts, and by their being unaffected by the action of the muscles: the usual dimpling of the skin when pinched up over them, and their lobulated exterior, proves their fatty nature. The only caution which can be required in their removal is to remember that occasionally fatty tumours in the middle line of the abdomen have been found to perforate the abdominal parietes; and, although apparently superficial, to spring from a root in the subperitoneal fat. Such tumours are called by French writers "*hernies graisseuses*."^{*} Their connexion with the peritoneum varies in different cases. The greater part, and usually the whole, of the tumour is formed by the subperitoneal fat merely; but in some cases a small process of peritoneum has been found in the centre of the mass, having apparently been pulled down by the traction of the tumour. At other times cysts have been found in the fat, unconnected with the peritoneum. Usually these small tumours require no treatment; but several cases are recorded in which symptoms of colic or of peritonitis have existed, which have been thought to have depended on the traction of the tumour, and which at least have subsided on the removal of the latter. When such symptoms are present, there would often be a good deal of difficulty in distinguishing the case from one of strangulated hernia. In cases of doubt, it is justifiable to cut down and examine the swelling, taking care to unroll the mass of fat before cutting it away, for fear of wounding one of these peritoneal pouches; but M. Nélaton gives the caution not to be in too great a hurry to operate on these tumours; and this advice coincides with that given by Mr. Birkett (p. 291) in all cases of umbilical hernia, where the symptoms do not very plainly indicate strangulation.

Other superficial tumours, whether innocent or malignant, differ in no respect in this region from their usual characters in other parts of the body. A word of caution may be given as to diagnosis. Most Surgeons must have seen psoas abscesses mistaken for tumours of the abdomen; a mistake not very creditable to the care of the person who makes it, since it shows that he has neglected to inquire into the history and symptoms of the case, but easy enough to commit on a mere cursory inspection of the part.

The deep tumours of the abdomen, which lie beneath the muscles, are next to be distinguished into loose tumours, tumours of the bones, and tumours of the viscera or peritoneum. Of the loose tumours, some lie in the subperitoneal cellular tissue. Among these I would especially call attention to a tumour of the iliac fossa recently described by M. Nélaton,[†] and of which an instance was lately under my own care.[‡] It is a firm rounded tumour lying in the venter of the ilium, moving with tolerable freedom under the muscular wall of the belly, and with a stalk which can be distinctly traced to the inner surface of the ilium, near the anterior superior spine. M. Nélaton has seen more than 15 cases; and it is a singular circumstance that all his patients were women who had borne children. This was so in my case also. He had operated twice with success, although in one instance he had been unable to avoid opening the peritoneal cavity. The tumour is of the fibrous or fibroid variety, and certainly bears to the naked eye a strong resemblance to the recurrent fibroid; but it did not recur in either of M. Nélaton's cases, and in mine 11 months have elapsed without any sign of renewed growth. In removing such tumours great care must be taken to avoid the peritoneum, if possible; and it is well to be contented with as small an incision as will suffice to expose the whole tumour; since ventral hernia will most likely ensue, and the patient's comfort demands that the hernia should be as small as possible.

The singular peculiarities of this tumour in having always a pedicle from the crest of the ilium, and in occurring always in the same form, and always, as far as present experience goes, in women who have had children, appeared

* Nélaton, *Path. Chir.* vol. iv. p. 394.

† *Gaz. des Hôp.* Feb. 18, 1862.

‡ *Path. Soc. Trans.* vol. xv. In the operation the peritoneum was not opened, and the patient recovered.

to deserve a special notice for it: but fibrous and other tumours may of course be found in other parts of the subperitoneal space. To all such tumours the same observation will apply, that the Surgeon should wait awhile and be in no hurry to extirpate them, unless the fact of steady growth is well ascertained; and that in doing so he must take every possible precaution both to avoid danger from a wound of the peritoneum if possible, and to guard himself from undeserved blame, should the tumour adhere so firmly to the membrane that its avoidance is impossible.

Malignant tumours, forming below the abdominal wall, will soon become fixed, from implication either of the viscera or the muscles; and thus the diagnosis will in all probability be correctly made during the interval of expectation above recommended in the treatment of deep-seated tumours which appear innocent.

Tumours which enjoy a wide range of motion are met with now and then in the abdomen, and are believed to be in many cases floating kidneys: but many of these tumours have had a range of motion far beyond what the kidney can possibly obtain.* In such a case as I heard of a short time since from a friend, where a lump in the belly could be moved from a little below the liver in a curved direction down into the iliac fossa and thence over towards the middle line, always maintaining the same limits, the loose body must have been either a foreign substance in the intestines, which was unlikely in that case from the direction and range of its motion, or more probably one of those concretions in the peritoneal sac so well described by Dr. Ogle and others.† The limits to the range of motion of such a substance might easily have been fixed by accidental adhesions. The point is one of not much practical importance, since in hardly any circumstances would the idea of cutting down on such a substance be entertained; yet if it seemed to be setting up peritoneal irritation, such a proceeding might not be wholly unjustifiable.

The tumours of the bones are generally malignant, though enchondromatous and other innocent formations may occur. They are found in the iliac fossa, or in the pelvis, by examination from the rectum or vagina, or lying on the spinal column. They are recognised by their fixed condition, and the broad base which always connects them to the bone. They frequently compress, and often implicate, the great veins, giving rise to œdema and venous congestion in the parts below. Some of the more malignant of these tumours pulsate, and thus simulate aneurism. The diagnosis has been spoken of in the essay on ANEURISM. The tumours which affect the spine, if they are large enough to be perceptible externally and to give rise to symptoms, are almost always malignant, and may sometimes be distinguished also by examination from the loins. The small exostoses, so common in old age on the front of the column, do not usually give rise to symptoms, and could hardly be felt from the outside of the body. None of this class of tumours is susceptible of treatment.

Tumours of the viscera of the abdomen constitute such a very large class, and are so very complicated in their diagnostic signs, that no sufficient exposition of the subject can be attempted here. They affect the liver, the omentum, the spleen, kidney or intestine, the general surface of the peritoneum, the bladder, and in the female the uterus, ovary, or broad ligament. Nothing need be said here about the tumours of the intestines, or of the female genera-

* Rokitsansky says, "The occasional movability of the kidney is owing to insufficient fixation by means of the adipose fascia, and apparently also to an elongation of the vessels: we sometimes find that the kidneys can be moved from one to two inches along the spinal column." *Path. Anat.* vol. ii. p. 188. Syd. Soc. trans.

† *Path. Soc. Trans.* vol. vi. pp. 204, 208. Vol. viii. p. 212: in this case the loose body was larger than a billiard-ball. Vol. xii. p. 89: here the loose body was felt in a hernial sac before operation. Other specimens will be found described in the same Transactions.

tive organs, or of the urinary organs, since these have been treated of in the essays on those subjects.

Tumours of the liver are recognised by their position, by their comparative immobility, and by their being situated in an area beyond which the liver can be recognised as extending (either by touch or percussion), or at least by the liver's dulness extending quite up to them; and when situated on the edge of the organ by their raising the false ribs. Such tumours as are merely attached to the liver* will be more movable; but it would be difficult during life to recognise these as hepatic.

The tumours of the liver met with in surgical practice are either cystic or malignant. Sir B. Brodie has described, in his *Lectures on Pathology and Surgery*, some cases of watery cyst of the liver, in which no proof was given of the presence of hydatid animalcules, and in which a cure was effected by simple puncture with a trocar; in two cases without any symptoms, in another after severe inflammation, and the bursting of an abscess into the intestine, followed by the discharge of a membranous bag, which, however, Sir B. Brodie did not regard as a hydatid.†

Large hydatid cysts are accompanied by considerable enlargement, the tumour being rounded and smooth, fluctuating, but less distinctly than the watery cyst, and with a peculiar vibration, due to the presence of the semi-solid bags in the fluid.‡ The smaller hydatid tumours, which are not perceptible externally, will not give rise to any symptoms. After some time ulceration may be expected to take place, by which the hydatids are transferred to some of the neighbouring viscera, or the sac suppurates and an abscess forms, which may burst internally or externally. In the latter event, the patient may survive; the others are almost inevitably fatal. Space would fail us to pursue the history of the disease if left to itself; our only object here is with its diagnosis and surgical treatment. The diagnosis of hydatid cysts is to be made from (1) an enlarged gall-bladder, (2) abscess, and (3) cancer. Other ambiguities may occur; e.g. when the cyst rises into the thorax it may be confounded with pleuritic effusion; when it lies in the central part of the abdomen, with aortic aneurism, &c.; but such difficulties are more rare. It will suffice here to point out the ordinary diagnostic signs. In the first place, then, hydatids grow without any feverish or hepatic symptoms, which is a strong point in their diagnosis from abscess of the liver and from enlarged gall-bladder. Otherwise the resemblance of some hydatid cysts to an enlarged gall-bladder is very striking; and it would be almost impossible to tell the difference by manual examination merely, as a reference to Frerichs' plate, mentioned in the note, will show. Next, the smooth round surface of the hydatid swelling usually distinguishes it from the more lobulated mass formed by a large cancer of the liver; and, lastly, the fluctuation and vibration of a hydatid tumour are in some cases to be clearly and easily distinguished from the semi-solid feeling of cancer. But it must be allowed that, in very soft cancers with smooth surface, if constitutional symptoms be absent, as they often are in rapidly-growing medullary cancers, the diagnosis can hardly be made without an exploratory puncture, which should in such a case always be made.§ I have seen cases in which the disease could not possibly be diagnosed without it.

* As the hydatid tumour figured in Frerichs on *Diseases of the Liver*, vol. ii. p. 242.—New Sydenham Society's trans.

† The occurrence of simple cysts in the liver, and the frequent coexistence of that condition with cystic degeneration of the kidneys, is illustrated in papers by Dr. Bristowe and Dr. Wilks, in *Path. Soc. Trans.* vols. vii. and x.

‡ This sensation is not always perceptible. Davaine recommends that in order to feel it, three extended fingers be applied to the most prominent part of the tumour, and that percussion be made with the middle one. Frerichs, *op. cit.* p. 242.

§ It is a measure, however, not absolutely devoid of danger. Frerichs (*op. cit.* p. 251) gives a case where death was caused by tapping a hydatid cyst and drawing off some of its contents with an exploring trocar.

When by puncture fluid (whether purulent or limpid) is discovered superficially situated in the liver, the question occurs whether it is right to open the collection, and if so, how? In case of abscess it would be advisable to open the collection as soon as practicable; and the safest way is by means of caustic (see vol. i. p. 163). In the case of a hydatid tumour, it seems better to wait until the fact of growth is decidedly established; since such tumours sometimes remain long stationary, and the operation is a dangerous one. But if the cyst be increasing in size, and if it be superficial, the risk of leaving it alone becomes probably greater than that of operating. Several plans are in use. The one most common in English practice is to make an opening into the sac with *potassa fusa*; other plans are to cut down on to the peritoneum, have the wound stuffed with charpie in order to excite adhesions, and then, after a few days, prolong the incision into the cyst; or simply to puncture and evacuate the tumour, as was done by Sir B. Brodie; or to keep the puncture open, and establish a sinus, through which the sac is washed out with warm water, diluted alcohol, solution of iodine, or even bile. Iodine is the fluid which has been generally used; but Frerichs seems to speak favourably of the use of bile as causing less pain, and correcting the putridity of the contents of the sac. The caustic plan, however, appears on the whole the least dangerous; but in order to secure the formation of adhesions around the opening of the sac, the caustic should be applied freely, and repeated on the separation of the slough till the sac bursts. The drawbacks to the plan are its painfulness and tediousness. If there be much redness, and the fluid seem very near the surface, it may be thought justifiable to open it by a simple incision; but it is dangerous, as the least escape of cyst-fluid into the peritoneum may set up fatal inflammation. If by palpation or on puncture the cyst is found to have undergone calcareous degeneration, as is not uncommon, no operative interference is justifiable.

Tumours connected with the spleen and the omentum less frequently come under the Surgeon's notice, since they are not the subjects of surgical treatment. The former are chiefly known by their situation, and by their raising the false ribs on the left side, as hepatic tumours often do on the right. Cystic or other tumours in the omentum appear more pedunculated than visceral tumours, and give rise to few symptoms when solitary; but the colloid and other soft formations usual in this part, are often merely a part of a general affection of the whole peritoneal surface, leading rapidly to death.

It is certainly theoretically possible that some of these looser tumours within the abdomen should be made amenable to surgical operations analogous to those on ovarian cysts; but practically it will be very difficult to find a case in which there shall be at the same time sufficiently urgent symptoms, and yet sufficient evidence of constitutional immunity, to justify a Surgeon in exposing his patient to the incalculable risks of such an operation.

The Groin.

The fold of the groin is one of the most fertile regions for the materials of surgical diagnosis; but most of these materials have been already treated of. Thus, in the essays on HERNIA and on the DISEASES OF THE MALE ORGANS, all the difficult and complicated questions of diagnosis connected with hernia, retained testicle, cysts of the spermatic cord, and all the varieties of hydrocele, have been studied, and the diagnosis of psoas abscess has been laid down in that on DISEASE OF THE SPINE. Artificial anus, again, as well as iliac abscess, and the abscesses forming around the *caput cæci*, have been spoken of in the essay on DISEASES OF THE ALIMENTARY CANAL, pp. 148 et seqq. The affections of the skin of the groin, among which intertrigo is very common, will be found described in DISEASES OF THE SKIN and ERYSIPELAS. The chief points which remain for notice are the affections of the lymphatic glands, and the rare instances of bursal tumours and cysts unconnected with the testis or cord. The tumour formed by an enlarged gland may often be confounded with a hernia; but on this point it is only necessary to refer to

p. 314. The mobility of the glands distinguishes all except that which lies in the femoral canal. In such cases the regions from which the inguinal glands derive their absorbents, viz. the lower limb (especially the toes), the wall of the abdomen, the nates, anus, and genitals, must be carefully examined, for the disease in the groin is but a symptom. The after consequences of abscess forming in these glands are often formidable, since they lead to ulcers with callous edges, in which often the enlarged and diseased gland is to be seen, or to sinuses which are often very intractable. In the first place, the remains of the gland should be extirpated with the knife, or destroyed by some caustic; the latter being perhaps the best plan, as these glands have little sensibility. If this does not suffice, the hard edges are to be destroyed with potassa fusa; or, as a last resort, chloroform is to be administered, and all the sinuses laid open to their very bottom by free and extensive incisions, the hardened edges being at the same time pared away. The wound must then be dressed from the bottom, the patient kept at rest, and liberal diet given, if the stomach will bear it.

Cysts are sometimes found in the fold of the groin, which are formed in the bursa lying near the hip-joint, under the tendon of the psoas muscle. If this bursa communicates, as it often does, with the hip-joint, the fluid will pass into the synovial cavity on pressure, and the tumour disappear on the limb being relaxed. If the bursa is separate, the rounded tumour will be irreducible. The diagnosis will be made from a consideration of these circumstances, and from the position of the small rounded tumour. The treatment will be that laid down in the essay on DISEASES OF THE MUSCULAR SYSTEM, vol. iii. p. 555. More liable to lead to error are those cysts and those abscesses which lie in close proximity to the femoral artery and receive pulsation from it. It is, however, sufficient to be aware of the occurrence (however rarely) of such diseases, and of the general rules for the diagnosis of aneurism (as laid down in the essay on that subject, vol. iii. p. 381), to avoid error. But much caution ought to be used, remembering that sad mistakes have been committed on the subject.

Cysts of many other kinds may form in the groin,—sebaceous, serous, sanguineous. Of these the sebaceous would differ in no respect from the ordinary disease as it takes place in other parts. The serous and other cysts are difficult of exact diagnosis without an operation; which should, however, be omitted until symptoms call for it. I have seen a blood-cyst dissected away from the sheath of the vessels in this part with good results. The patient was a young woman under Mr. Hewett's care.*

Finally, it may be advisable to call attention to the occasional occurrence of disastrous or even fatal hæmorrhage from the spread of phagedænic, strumous, or cancerous ulcers in the groin. The diagnosis of these forms of ulcer presents no difficulty in the groin beyond what it does in other parts; but this peculiarity in the relations of the femoral artery should make us more than ordinarily anxious to stop the spread of specific ulceration in the groin. Powerful caustics, such as potassa fusa or nitric acid, are the only local measures which can be trusted to arrest such of these ulcers as allow of treatment. The more active forms of cancerous ulceration are, of course, hopeless.

The Popliteal Space.

The popliteal space is to be regarded, from a surgical point of view, as a large loose areolar interval in which the great vessels and nerves pass behind the knee-joint, and whose size and the laxity of its tissues allow them to move freely out of the way of the ends of the bones in forced flexion and extension. The glands which lie in this areolar tissue, the tendons and the bursæ in relation with them, must engage the attention of the surgical anatomist as well as the vessels and nerves. It is unnecessary for us here to go over the familiar points, which may be found in any treatise on descriptive anatomy; but it

* *Path. Soc. Trans.* vol. ix. p. 383.

may perhaps serve a useful purpose to give an account of the usual arrangement of the bursal sacs which are in connexion with the tendons.

In the *Archives Générales de Médecine*, 1856, sér. v. tom. viii. pp. 313, 425, M. Foucher has written an elaborate memoir on the tumours produced by enlarged bursæ in the ham, which will well repay perusal. M. Foucher there gives a description of the usual arrangement of the bursæ, which my dissections (though less numerous than M. Foucher's) enable me to confirm. There are found, according to this author, on the inner side of the ham two bursæ—one between the inner head of the gastrocnemius and the femur, which sends a prolongation also between the gastrocnemius and the semi-membranosus, and is in close contact with the ligament of Winslow. This bursa very often communicates with the joint,* especially if it is enlarged. The second bursa, at the inner side of the space, lies between the tendon of the semi-membranosus and its insertion into the head of the tibia. It is of smaller size than the preceding, with which it is in contact above, and sometimes in communication. In such a case this bursa may communicate with the joint, but not otherwise. Besides these, I have found, but only once out of nine dissections, a small bursa between the tendons of the semi-membranosus and semi-tendinosus, which is probably an accidental formation. On the outer side of the space a separate bursa is sometimes found under the outer head of the gastrocnemius, but more frequently merely a prolongation of the synovial membrane. There is also usually a pouch of the synovial membrane of the joint, between the front surface of the tendon of the popliteus muscle and the posterior ligament. This pouch may be replaced by a separate bursa. On the opposite (back) surface of the tendon, between it and the external lateral ligament, lying close to the peroneal nerve, there is usually a separate bursa.

Besides these regular and natural structures, which can always be recognised by dissection, there are also found other closed sacs, which appear to be diseased products. Thus M. Foucher notices that, in dissecting the popliteal space, he has occasionally met with cysts having no communication with the joint, and not situated in the position of the tendinous bursæ. These cysts he believes to be in most cases dilated synovial follicles;† although he admits the possibility that some of them may be formed by a hernial protrusion of the synovial membrane through an opening in the ligamentous capsule, which afterwards becomes obliterated.‡ Other cysts are found, though rarely, in the cellular interspaces, which appear to be simply accumulations of fluid in the

* M. Foucher says almost always in adults and old persons; a point which I regard as very doubtful.

† On the nature of these synovial follicles, see Gosselin in *Mém. de l'Acad. Imp. de Méd.* vol. xvi. He there establishes the following propositions:

I. The articular synovial membranes in general, and that of the wrist in particular, are provided with prolongations, or culs-de-sac, which he calls "crypts," or "synoviparous follicles."

II. The obliteration of the orifices of these crypts, and the accumulation of synovia in their interior, is the origin of the cysts in question (*i. e.* the ordinary ganglions).

These two propositions are applicable to the knee-joint, though the occurrence is less common than in the wrist.

‡ In dissecting the popliteal space on either side in the body of a woman, æt. 38, I found on each side a large accumulation of fluid in the bursa beneath the inner head of the gastrocnemius. On one side there was no communication with the joint, which was perfectly natural, and contained no fluid. On the other side the enlarged bursa communicated with the synovial cavity, which also contained a considerable quantity of the same thick yellow fluid as the bursa. But, besides, there was on this side, adherent to the posterior surface of the ligament of Winslow, in its centre, a very small closed sac, containing similar fluid. The sac and the adjoining portion of the ligament, with its synovial lining, were removed from the body and carefully examined. No communication whatever existed, but there was

meshes of the areolar tissue, which have become enclosed in a capsule. If we follow this division, we shall have four classes of cysts in the popliteal space:

1. Bursal cysts, or dilatations of the above-mentioned bursæ of the tendons.

2. Follicular cysts, or dilatations of the synoviparous follicles.

3. Synovial cysts, or cysts formed by hernial protrusions of the synovial membrane.

4. Free serous cysts, or accidental cysts.

It must, however, I think, be allowed that the second and third classes have not yet been proved to be anatomically distinct from each other.

The first question which occurs in examining a rounded tumour in the popliteal space is, whether it is an aneurism, an abscess, an enlarged gland, a solid tumour, or a cyst. There is usually very little difficulty in establishing the diagnosis of the latter form of disease,—in fact, when the cyst projects from the outer or inner aspect of the limb, there can be hardly any ambiguity in the matter. This is the case in the great majority of instances; those cysts being, as far as I have seen, the most common which are formed by the expansion of the bursa lying between the femur and the inner head of the gastrocnemius with the semi-membranosus muscle. But when the cyst presents, as it occasionally does, in the centre of the space close upon the popliteal artery, it may very closely simulate an aneurism at first sight. The diagnosis depends upon these particulars: 1. The cyst, though it contains thin fluid, is not altered in size by compression applied while the circulation in the artery is arrested; the aneurismal tumour is emptied partly or entirely under similar treatment, while it contains fluid. 2. The sound communicated to the ear applied over the tumour is never of the same prolonged blowing character with that usually heard in aneurism. 3. The pulsation communicated to these cysts is never of the expanding character of the pulsation observed in an aneurism with fluid contents. 4. Most of these cysts can, in some position or other of the limb, be dragged away from the artery, and the pulsation in the tumour then ceases entirely, though that in the artery continues unaffected, which is never the case in aneurism. 5. To these diagnostic marks Mr. Hart, in reporting a case mistaken for aneurism,* has added, that in rigid extension of the limb the pulsation of the cyst almost disappeared. Finally, if, after a very attentive examination, the Surgeon cannot yet make up his mind, it will be justifiable to clear up the doubt by inserting a grooved needle; but this measure will be hardly ever resorted to after a sufficient examination in any case which afterwards proves to be an aneurism.

It is impossible sometimes to diagnose the nature and connexions of blood-cysts before dissection. Of this the following interesting case is an example: A woman was under the care of Mr. Moore, at the Middlesex Hospital, for a smooth swelling in the popliteal space, supposed to be a bursa. In a few months after she was first seen, the tumour appeared solid, deep-seated, and was thought to be a cluster of glands. Again, ten months later, it nearly doubled the size of the knee, projecting backwards in lobes between the hamstrings and gastrocnemius. It was doubtful whether it was solid or fluid, its feeling varying at different examinations. The chief symptoms were acute pain darting along the nerves to the foot. Sometimes she could not bear a touch. On puncture with a grooved needle, slightly reddened serum escaped, which, as it flowed, became more and more red, till at last it became pure blood. Whilst the needle was held steady in the tumour, she suddenly cried out from excessive pain shooting to the foot. For three or four minutes after the needle was withdrawn, the tumour remained soft; but then acquired the

a distinct pin-hole depression on the synovial face of the ligament, corresponding to the part where the cyst adhered. There were, therefore, strong grounds for regarding the latter as formed by a protrusion of the synovial membrane, or of one of the above-mentioned follicles, through the ligament.

* *Med. Times and Gaz.* 1862, vol. i. p. 377.

same tension as before. A tourniquet was applied, and the tumour cut into. The sensation to the finger was exactly that presented by the right ventricle of the heart. Nothing but blood and a few fibrinous coagula escaped: the venous bleeding was very free. The limb was amputated, and the disease then proved to be a cyst, communicating with some deep vein, and developed like a neuroma in the substance of the posterior tibial nerve, the fibrils of which were expanded in all directions over it.

Treatment of popliteal cysts. The treatment of these cysts is usually successful. It may be conducted on the same principles as those already laid down in the essay on DISEASES OF THE MUSCLES (vol. iii. p. 555) as applicable to enlarged bursæ of tendons. But the frequency with which a communication exists between the enlarged bursæ of the hamstring tendons and the joint, and the chance that the cyst, if seated in the centre of the ham, may be a protrusion from the synovial membrane, should make the Surgeon very cautious in treating these cysts by any of the severer methods, such as injections and setons. It is quite true that such methods have been used, and successfully, when the cyst has been known to communicate with the knee-joint;* but they must always be held to be dangerous; and should not be resorted to unless after a patient trial of other methods (such as puncture, followed by blistering) which are free from any risk. These mild measures will often succeed, when combined with rest. Nor should it be forgotten that the communication is not always obvious, even in cases where it exists. The opening may be but small, and pressure on the cyst may cause no appreciable quantity of fluid to flow into the joint, unless applied for a considerable time; or the opening being of the nature of a slit,† may be closed in the extended position of the joint, though open when the knee is flexed. In any case, if injection be the method employed, the knee should be kept firmly extended. Iodine seems the best material for injection, though alcohol and ether have been successfully employed. The injection-treatment seems to have been so successful that the difficult and dangerous method of excision ought not to be resorted to in any case; and when the cyst communicates with the joint, it is wholly out of the question. Setons should be reserved for use on the failure of injection.

The diagnosis between an abscess in the ham and any of the affections with which it may be confounded is usually very easy. The inflammatory appearance of the integuments would suffice to distinguish it from a cyst, as well as from a solid tumour.‡ The chief ambiguity would be between an abscess and an aneurism in which suppuration of the sac has taken place; or between an abscess following injury and an effusion of fluid from rupture of the main vessels. On both these heads the investigation of the pulse in the artery below will give important and often decisive information. As to the former case, the history and symptoms of aneurism will have existed, and, if the patient is a person of any intelligence, will not fail to guide the Surgeon to a right conclusion. In such cases the aneurismal bruit and pulsation have generally been obliterated by the inflammation. It is true that an incision will be required both in the abscess and in the suppurating aneurismal sac; but it is most important not to open a suppurating aneurism, believing it to be a simple abscess, since amputation may become immediately necessary; a contingency for which the Surgeon should assuredly have prepared both himself and his patient.§

* Foucher, op. cit. obs. i. p. 321.

† See a case dissected by Foucher, op. cit. p. 320.

‡ It should be remembered that cysts may suppurate as well as enlarged glands, and that abscess may occur in or near a solid tumour; but then such cases become abscesses, and must be so treated.

§ Most readers will recollect the case, so well described by Roux (*Quarante Années*, &c. vol. ii. p. 48), in which Cullerier opened a suppurating aneurism in the groin.

Rupture of the great vessels in the ham always, as far as recorded cases show, implicates the artery. The vein also may be torn in cases of ruptured artery; but I am unable to refer to a case where it has been the only vessel injured. The accident would be diagnosed from abscess by the suddenness of the occurrence of swelling, which comes on instantaneously at the time of the accident; the absence of inflammatory cedema or increase of temperature in the superficial parts of the ham, the loss of temperature in the foot, the failure of circulation in the lower arteries, and the tendency to gangrene.^{*}

The treatment of ruptured artery ought, I think, to depend on the extent of the effusion. If this is only moderate, and there is reason to hope that gangrene may be averted, it seems better to wait, hoping that gangrene may not come on, or that its extent may be limited. If gangrene be present to any considerable extent, amputation should be performed at once. If there be very considerable ecchymosis, but the foot be not gangrenous, then the operation performed by Mr. Poland for tying the two ends of the vessel and removing the clot may be repeated.[†] There is no reason, as far as I have seen, for hurry in the treatment of these cases. In two such accidents which have been treated of late years at St. George's Hospital, amputation was perfectly successful, though long delayed in each case. It may even be questioned whether the operation is not more likely to succeed if performed after the feverish symptoms accompanying the first onset of gangrene have subsided.

The regional surgery of the popliteal space would be very incomplete without the mention of that which is perhaps the most common cause of embarrassment in operations conducted in this region—viz. the frequent formation of a sequestrum in the part of the femur directly adjoining the popliteal artery. This sequestrum is seldom, if ever, separated from the vessels by an invaginating sheath, as is usually the case in other parts of the body. No satisfactory cause for the commonness of the disease, or for the absence of the periosteal sheath, seems to have been given. Numerous accidents in the removal of these sequestra have happened; the artery has been opened by the knife or the trephine, or lacerated by the sharp edge of the sequestrum; and cases in which the loose bone has been driven into the artery in the ordinary movements of the limb are on record, and have been referred to at vol. iii. p. 645. Hence much caution is necessary in extracting such sequestra. A free incision at one side (the outer is best) should be made, and the dissection carried along the face of the bone until the dead bone is reached. If it be not thoroughly loose, the operation had better be deferred till it shall become so. If it be found loose, it should be gently raised from its bed with an elevator, and drawn outwards with flat forceps. If the extent of the dead bone be too great to allow of its ready extraction, it is better to cut it across with the bone-scissors than to use any force. If, notwithstanding all his care, the Surgeon is so unfortunate as to wound the popliteal or any large artery, he must have the circulation commanded by pressure on the femoral, while he rapidly enlarges the wound and ties both ends. Failing this, amputation has been found necessary, and even death by hæmorrhage has occurred.

Limbs. In the continuity of the limbs, the chief questions connected with regional surgery which occur in practice are those which relate to the relative positions of arteries and nerves to tumours or diseased portions of bone. Interesting points of surgical anatomy are frequently raised by these operations, but they are too numerous and too miscellaneous for discussion here. An intimate and ready knowledge of anatomy is the chief requisite for safely conducting such operations; but the Surgeon must not forget that tumours and abscesses often displace the structures. An instance of this has been

* Compare Poland on Rupture of the Popliteal Artery, in *Guy's Hospital Reports*, ser. iii, vol. vi. 1860.

† See vol. iii. p. 504.

given at p. 943 in the displacement which the femoral artery suffers in chronic abscess of the thigh; and similar displacements are of course still more common when tumours grow among the main vessels and nerves of a limb. For this reason, in the removal of such tumours, it is very desirable to commence the dissection from above, where the structures have their natural position, and thence trace them downwards. But the affections of the limbs have been so extensively described in the essays on the DISEASES OF THE MUSCULAR SYSTEM, BONES, JOINTS, and SKIN, that I must refer the reader to those essays for all that is necessary on their diagnosis and treatment.

T. HOLMES.

ON HOSPITALS.

IF there be any merit in the following attempt, it consists in having brought together the scattered elements of a subject not as yet generally understood as a whole. The endeavour may be well capable of improvement, as well as of extension; and I shall esteem myself fortunate if I may at some future time enjoy the privilege of contributing both to the improvement and the extension of so beneficent a subject.

To pretend to originality in such an undertaking would be about as just and true as to pretend to write the original statistics of an empire, or to write a cyclopædia.

In considering the objects and uses of hospitals we must always hold in recollection that, however excellent and necessary in themselves, they have but a subordinate station in the body politic of medicine, comparatively. They relate only to the cure of disease; and thus minister, according to Bacon, but to the "necessities of mankind;" while the nobler division of the science of medicine aims at the promotion of the general welfare, by ministering "to the Divine power and goodness both in prolonging and restoring the life of man." "In the words of Bacon," says Dr. William Farr, "if physicians" (and we may add governments) "will learn and use the true approaches and avenues of nature, they may assume as much as the poet saith:

*'Et quoniam variant morbi, variabimus artes;
Mille mali species, mille salutis erunt.'*"

The objects and uses of hospitals are: the recovery of health; recovery from sickness in the shortest time, with the smallest mortality, and at the lowest cost consistent with efficiency.

But an army in hospital,—as at Walcheren, at Rangoon, and in the Crimea,—what availeth it to the statesman or the commander? It is an encumbrance, a waste, a nullity.

Hospitals are in some sort the measure of the civilisation of a people; they are better adapted to its wants, and better constructed, in proportion as communities are united, more humane, and more instructed. They may be regarded likewise as nature's schools, where pupils are taught her ways in diseases and casualties. As asylums for the sick and hurt, they are the most splendid expressions of wisdom and benevolence; particularly in the immediate assistance they afford to external injuries. So important, indeed, is their right management to the welfare of armies, that negligence in this respect may produce vastly more injury than twenty sanguinary battles.

Hospitals are, indeed, to be considered under two points of view: the first object is, to provide healthy and commodious lodging, and attendance, medical and surgical, with assistance and suitable diet; the second object is, to provide schools of instruction for students in medicine and surgery.

In an assemblage of men united into one society we shall find a certain number of poor, a certain number of sick,—the one and the other being a

charge upon the public. The extent and number of hospitals in a city would appear to be regulated by the amount of indigence and sickness compared to the population. But as all inhabited places are not equally healthy, nor all industrious classes equally healthy and prosperous, it sometimes happens that in populations of equal numbers there will be more poor and sick on the public charge in one place than in another; besides which, certain hospitals admit a class of sick which are not received in another. Certain towns comprise a large district, while others offer a kind of thoroughfare. These accidental circumstances render it necessary to increase hospitals, and certainly break the relation of the extent of charitable institutions to that of the populations. Add to this, that it is not known in a given number of inhabitants what is the number of the necessitous and of the sick who require charitable institutions. On this point one can only have recourse to facts drawn from the hospitals themselves, compared to the population, to the nature of the trades, especial charities, and to the position of each town; but it is of importance that we should have them collected, in order that we may be enabled to draw useful results from them; it is a work necessary to be done, to guide us with safety when it concerns the procuring an hospital for a city.

The wants of humanity are various, numerous; they claim different kinds of relief; those who receive succour from them are in different positions. It is necessary, therefore, that there should be many modes of assisting the distressed poor. There are ills which can only be treated in hospitals; others for which houses of refuge are necessary; others, again, to whom succour can only be effectually given in their houses.

The hospital—the equivalent to the *hospitium* of the Romans, and to our own *hotel*—was, in cloisters, the place of shelter to strangers, whether rich or poor. Bearing some resemblance to our present hospitals were the public buildings for the aged women of Delos, built on the island called Rheneia; and those buildings which at a later period were erected near the temple of Æsculapius for sick persons coming in search of health. It was possibly a similar institution which Antoninus built at Epidaurus. Another appears to have existed on the island of the Tiber at Rome, to which sick slaves were brought to be healed. Bethesda (house of mercy), with its five porches, was a place in Jerusalem to which the sick were brought to await the moving of the waters. Also the *Taberna Emeritorum* at Rome appears to have been an hospital for invalids.

So early as the Council of Nice, A.D. 325, hospitals are spoken of as commonly known; but the first celebrated hospital was that of Casarea, A.D. 370-380, richly endowed by the emperor Valerius. It was of immense dimensions. After it followed the hospital of Chrysostom at Constantinople. In the ninth century there were twenty-four hospitals in Rome alone. A foundling-hospital was established at Milan A.D. 787; and a lazaretto about the same time in Constantinople; and an orphan-hospital in the same city, A.D. 1090, by Alexius I.

A consideration of the political, social, moral, and religious state of pagan antiquity must render it self-evident that they had not, and could not have, hospitals founded on the principle of CHARITY—a virtue of Christian origin. To Christianity solely, then, do we owe the institution of hospitals for the reception and cure of the sick; the very scattered and uncertain notices to be found in the histories of the Greeks and Romans, as of Asiatic nations, exhibiting only doubts and uncertainties. It was Christianity alone which really and practically revealed the truth that all mankind are one, and that human nature is the same in all. Christianity has not only its abasing, but its *elevating* side; and the tendency here quoted may be accepted as an essential part of the history of Christendom.

Mr. Raikes, writing in 1858, says: "Nothing astonished the earliest European traveller in India so much as the solicitude of the Gentoos for insect life, and their profound indifference to human suffering. Men died by the

road-side uncared for; but for bugs and fleas regular hospitals were furnished." "An hospital for the sick poor," says Tennant, "was never known in India before the British, though there were places of reception for dogs, cats, lions, and other animals, but none for men;" while the noble buildings of Greece and Rome, and of other pre-Christian times, were erected for purposes other than those of charity.

General Ambert says: "Neither Greece nor Rome, great and glorious as they were, had their hospitals, whether civil or military; neither Greece nor Rome could have given birth to the Sister of Charity. Civilisation may produce heroism, which enlightens and influences; but Christianity alone can engender charity, which warms and kindles."

Cæsar states that on the night preceding one of his battles, he ordered the sick and wounded to be conveyed to the nearest town. This precaution of removing the sick from the camp, and collecting them in a town, where they could enjoy repose and the best assistance, is surely the principle of the institution of military hospitals. Fabius, after his victory over the Veii, is said to have distributed his wounded among the nobility, who opened their houses for their reception. Severus ordered that chariots should follow the army on the march, for the conveyance of the wounded, who were subsequently placed in the charge of families, who were paid by the state for their care and outlay. These are the first ambulances on record, according to Mr. Fonblanque; who adds that, notwithstanding the soundness of the administration-system and the advantages of good roads and dépôts, the Roman soldier was required to render himself as independent as possible of extraneous aid, and to carry from fifteen to thirty days' provision of grain, in addition to his armour, his weapons, his handmill and cooking-utensils, and his palisade. But, along with perfection of training in the individual soldier, there existed a great military administration—a commissariat department.

During the Crusades, and while the science of destruction had made rapid strides, that of preservation and cure had retrograded, and the unskilled devotion of individuals could do little to assuage the horrors of famine, pestilence, and the sword. Yet the example had been set of providing an asylum for the victims of war; the claims of the suffering soldier had been recognised; the virtue of humanity had been reduced to practice; and a precedent had been established, of which future generations derived the benefits. While prudence and humanity were lost in fanaticism, and only one-tenth of what was dignified by the designation of army reached its destination, it is nevertheless to this period that we may truly trace the first attempt at the establishment of what must be regarded as military hospitals. The Crusaders who escaped the dangers of battle fell victims in great numbers while performing the humblest offices of an hospital-nurse among their plague-stricken comrades.

It is curious in the history of progress to observe how gradually and imperceptibly philanthropy, from being only a speculative principle—a mere sentiment or abstraction—came to be a vast power; at one time to cause the abolition of slavery, and at another to bring cheap bread to the poor man's board. The interests of society at length forced it into general acceptance; but so great a change required many centuries for its maturity. A benevolent principle is implanted in our nature, which, independently of the sense of duty, or of the approval of reason, induces us, by an involuntary emotion, to relieve the distresses of our fellow-creatures, and those of our native country especially. Under the influences of a benign religion, operating upon those impulses of our nature, we perceive our country covered throughout with the most noble institutions for the sick and the distressed. Their establishment reacts favourably on the public mind. Hospitals improve the disposition of mankind by cultivating charity. A degree of dependence upon public opinion and munificence is therefore useful.

The miseries of the Crusades among the military classes, and the extension, violence and duration of leprosy among the peoples of Europe, brought about a necessity, in the middle ages, for the establishment of hospitals; and

we find that Childebert, the son of Clovis, raised such establishments as the Hôtel-Dieu of Lyons, that of Paris, and of Autun, which were enlarged and improved by succeeding princes. In truth, we possess abundant practical proofs, both ancient and modern, in every country in Europe, of the interest and solicitude with which institutions have been erected for the cure of the sick poor; and the names of their founders are held in perpetual honour. It is true that in the lustre of public charities, misery, of a nature not immediately to attract the eye of pity, often remains unnoticed. But society must be content to do what can be done.*

The Hôtel-Dieu of Paris is said to date from the end of the seventh century. It is placed near the greatest temple of the capital: "The place where the people pray, and the place where they suffer, are alike the house of God."

The earliest notice of the establishment of an institution for the reception and cure of sick in England, is contained in the life of Lanfranc, Archbishop of Canterbury, in 1070. In this building there are said to have been separate apartments for men and women. But, before the foundation of any institution having the character of hospitals, the germ of the provision now made by law for the relief of the indigent was planted by the Christian Church, in the devotion of a third of its tithes, ratified by express enactment of the Witten, to that charitable aid which was administered by the clergy to the poor. The idea of a provision for indigence by a charge on all fixed property was of much later growth. That was a regulation of police which gave security to life, in order to protect property by suppressing vagabondage and crime.

Looking to modern times, we find that after the Reformation in England, by the dissolution of the monasteries and the consequent abolition of monastic orders, the way was happily opened to their conversion into charities, on the present system of establishment. These events unveiled all the mysterious management by which benefactions had been received and misapplied; and gave every benefactor not only the power of founding, but also of making rules for the foundation: hence these have become open to general inspection, and the intention of any benevolent donor is carefully fulfilled. The result has been, that private and public charity has become universal. The veil of humility and charity conceals an enormous amount of private benevolence; but the benevolence which is public in England is seen every where.

Many of the hospitals and "hospices" in foreign capitals may be said to combine the functions of our English hospital with those of our Poor-Law Board, provision being made in them not only for the cure of the sick but also of the infirm and insane. "The first military hospital established in Europe," says Mr. Fonblanque, "was erected by order of Richelieu, at Pignerole in Piedmont, where the building still exists." The hospitals of London, as those of Paris, have been alike founded by individual charity. Not to speak of legislative and parochial systems of taxation for the support of the poor, no part of the army or navy, the church, or other establishment; not the smallest congregation for worship among the many denominations of Christians or Jews; not the smallest district or set of hamlets, unknown to the passing traveller, and too insignificant to find a place in the map; not a town or city, parish or ward, throughout the United Kingdom; not a manufactory; not a corporate association, company for trade, agriculture, science, education, or medicine; not a club for the enjoyment of festivity, or the pleasures of the chase, or for the indulgence even of luxury in her various folds; not even a theatre—will be found without their respective institutions

* "No mention is made of field-hospitals or army-surgeons in the middle age until about the fifteenth century, when field-surgeons were appointed for the use of the commanders and principal officers, but not for the service of the field-hospitals. In no part of Europe was the administration of hospitals rescued from the hands of the clergy. Even on the field of battle priests were esteemed above Surgeons, if we may depend on Mochsen, who states that, by order of the first council of Ratisbon, every commander should have two bishops, with priests and chaplains, and every colonel should be attended with a confessor." Dr. Meryon's *History of Medicine*.

of charity, to which a willing and prompt subscription flows, almost without solicitation. Thus every individual in England, according to Mr. Highmore, becomes a benefactor to others, and thereby is the greatest benefactor to himself.

We have in all this the practical proof that, in our native country, one of the first of duties is held to be to feel for man, and that the most distinguished ability and the greatest success in life are valueless when that duty is neglected.

It results from this universal diffusion of charity, that there is not a disease that can afflict human nature, nor a want which the varying condition of man can require, nor any one of the manifold visitations of adversity, in poverty or distress, but finds an open asylum, a resort ready prepared with every needful accommodation for reception, entirely free of expense.

But while our feelings are divided between wonder and admiration of the magnificent moral display of national and individual charity—the most benign of all the virtues, “the very bond of peace and of all virtues”—we must not allow ourselves to suppose that in England benevolence has at any time been permitted to rush heedlessly at the object of its desire, unrestrained by POWER and ORDER; for far otherwise has been the fact. That which indeed graces the British capital, almost as much as its noble charities—“the memorials that renown our city”—is, the great and unquestioned character of the general administration of its public institutions. It is thus that London, in the magnificence, and in the comprehensiveness of its associations and societies, reflects the moral qualities of the United Kingdom.

In presenting the following details of construction and arrangement for hospitals, I have quoted from different sources, and very much from the writings of Miss Nightingale, as affording at once the largest and most matured experience, with the best descriptions that I am acquainted with.

In concluding her invaluable observations on “the sanitary condition of hospitals and hospital construction,” she offers the following characteristic exhortations: “I have here given the defects; few have had so sad or so large an experience of their results as I have had. I appeal to those who are wiser, and have more practical power than I have, for the remedies; to architects, to hospital committees, to civil and military engineers, to medical officers, to officers of health, to all men of science and benevolence, of whom our country is so justly proud. It is hard that in a country where every thing is done by a despotic government, such advances in the sanitary construction of hospitals should have been made, and that our England, which ought to take the lead in every thing good, should be left behind.”

I have also consulted various British and Foreign authorities on the subject of hospitals, both civil and military: as Pringle, Lind, Blane, Robert Jackson, Brocklesby, Donald Monro, Aikin, Percival, Blizard, Champney, Highmore, Rollo, Stewart, Henderson, Ballingall, Lee, Wilde, Phelan, Carter and Cross, Parkes, Robertson, Walker, General Report of the Barrack and Hospital Improvement Commission, *The Builder*, *Encyclopædia Britannica*, *N. British Review* for August 1858; *Journ. Statist. Soc. of London*; *The Charities of London* by S. Low; Report, 1837, of Commissioners on Charities in England and Wales; Report of Commissioners on Hospitals of Dublin, 1856; Dr. William Farr on Vital Statistics, and his various sanitary reports; also the Sixth Report of the Medical Officer of the Privy Council for 1863. Of foreign authors these are the principal authorities referred to: Tenon, Recalde, Daignan, Iberti, Delaunoy, Breschet, Courtin; *Arrête des Conseils*; *Rapport fait au Conseil Général des Hospices*; Jardien, *Hôpitaux et Hospices*; *Cours d'Administration Militaire* par M. Vauchelle; *Rapport sur Hôpitaux, Hospices et sur la Mendicité* par A. E. Cerfbere.

SITE AND CONSTRUCTION.

If it be undisputed that hospitals may be made to render great services to the public health, it is equally so that the nature and amount of such services must depend on the rigour with which we attend to their sites, construction,

and administration. In our older histories we find terrible examples of the destruction of health and loss of life caused by neglect in these essentials.

If we had carefully considered the nature of man in health and in disease, along with his various requirements under each condition, our hospital-wards and our barrack-rooms would not have been constructed like a hotel, having room-within-room, on principles purely arbitrary, or on no principles at all.

"It should never be forgotten for a moment," says Miss Nightingale, "that on the purity of the air of a ward depend, in a great measure, the recovery or death of the sick and maimed, the usefulness or injury arising from the hospital, the duration of cases, and, consequently, the hospital economy; whether, in short, a hospital, planned, erected, and supported 'by voluntary contributions,' is to be a blessing or a curse to civilisation. And when we consider that a man cannot forego this supply of air so many minutes as he can forego food for days, is it a subject for wonder that pure air should be the main condition, as of health, so of recovery?"

The desideratum to be determined by sanitary and architectural science is this: can we, by a proper selection of site, and by proper structural arrangements, rescue the inmates of our great hospitals of the United Kingdom from a mortality, which, according to Miss Nightingale, ranges from "four and a half per cent to nearly sixteen per cent." These averages are reckoned *on the cases treated*.

On the geometrical dispositions of the architect depend, not only the renewal of air, so indispensable to an hospital, but in a great measure its interior police, the regularity and promptness of the service. With simple forms of distribution, adapted to the wants of hospitals, nothing escapes supervision; in one *coup-d'œil* we embrace the service and the sick, while we secure care and exactness in the performance of duty.

The following principles of construction are presented as the best hitherto discovered:

1. That no hospital shall consist of more than three stories in height.
2. That by such arrangement the sick are spread over a wider area, the walls not being so high as to interfere with the ventilation and sunlight of neighbouring pavilions; while the accumulation of hospital miasm in the upper floors is avoided.
3. Such construction facilitates the access to the wards by patients and attendants, and the whole administration is rendered easy.
4. All the most approved hospitals on the Continent, as the Lariboisière of Paris, are built in three flats; and it would there be esteemed nothing short of breach of trust to erect lofty and massive buildings within a crowded city.
5. In constructing wards, they should be so built as to be flooded with sunlight, and that the windows shall bear a large proportion to the wall-space of the hospital. Experience proves that window-space ought not to be in a much less proportion to wall-space of an hospital than one to two.
6. The free admission of light has every where been proved beneficial to health and conducive to cheerfulness; while, as often observed in ill-constructed barracks and hospitals, the exclusion of light has proved detrimental to health directly, and also by retarding convalescence.
7. The best principle of hospital construction is that of separate pavilions placed side by side, or in line. The former is very preferable for large hospitals, for the reasons already stated; and there should be but three flats in a pavilion, and one ward to a flat. Pavilions are, in fact, separate hospitals, having a limited number of sick under one roof.
8. The form of the hospital should be an oblong square, the basement story of the pavilions being connected by a corridor, and the whole of the basement erected on arches. The pavilion plan is generally received on the Continent as the sanitary necessity for hospital construction.
9. It is undesirable to increase the width of any ward beyond thirty feet, because the distance between the opposite windows becomes then too great for efficient ventilation.

10. Windows should be double, or glazed with plate-glass, to prevent loss of heat. Tripartite windows, like those of the Middlesex Hospital, are useful for ventilation.

11. The ward-walls should consist of pure white Parian cement, or some equally white non-absorbent substance. Gray-coloured cements should be avoided; they never look clean, and they give the ward a sombre appearance, and hide dirt.

12. The best ward-flooring is oak; and the joints of the flooring should be well fitted together, so as to be impervious.

13. No sawdust, or other organic matter capable of rotting, should be placed underneath hospital floors.

14. Floors should be bees-waxed, or oiled and polished.

15. The general baths of the hospital should be separated from the pavilions, but connected with the corridor. They should contain hot and cold water, medicated, sulphurous, Turkish, vapour, shower, and *douche* baths.

16. The kitchen should have walls and ceiling of Parian cement, or other such material.

17. There should be a head-nurse's room and scullery attached to each ward, and store-presses outside the wards.

18. Bedsteads should be of iron, and be supplied with hair-mattresses. The ward furniture should be of oak. Whether regarded as a means for securing sleep, rest, muscular relaxation, or repose, the bed is a direct auxiliary to the cure, and too much care cannot be given to its construction and situation.

19. The ward construction now described is that which, up to the present time, experience has shown to be best suited for fulfilling all the requirements of ventilation, light, cheerfulness, recovery of health, and economy, in this country.

20. One great advantage of the proposed system is, that it admits of any arrangement of the pavilions on a plan which is consistent with light and ventilation. For lighting, gas is always to be preferred. Hospital establishments so constructed may be added to without difficulty and without altering, or indeed without interfering with any of the existing pavilion buildings.

21. The principles of hospital construction here advocated are at variance with those of almost all the hospitals of the three kingdoms; but the whole question, in all its importance, is in the hands of the profession and of the public; and observation, experience, and free discussion, will ere long determine what is just and true.

22. Most of the great hospitals and charitable institutions of this country were suburban at their foundation; the rapid growth of our towns in modern times has encroached so much upon space once country, that gardens and fields have been absorbed, and are now covered with bricks and mortar; and hospitals are surrounded by the screaming and roaring traffic of railways, street-cabs, omnibuses, and wagons.

23. It is due to the founders of our great charitable institutions that their humane intentions should continue to be realised by removing the sick and maimed to pure air and quiet. It is due to poor suffering humanity that any plans adopted should be the most perfect which modern intellect can devise; and it is no less due to the cause of charity that there should be the best and most economical form of hospital nursing and management.

24. I have here confined myself to a consideration of the best-known plans of hospital-construction, believing that a review of second- and third-rate plans is but waste of time. In crowded cities we must be satisfied with what can be done; but I feel assured that, wherever practicable, such plan and arrangement as those of Miss Nightingale will in the end prove the cheapest, whatever the price of ground may be.

The following is a brief summary of the principles of hospital-construction here recommended:

(a) Never erect a general hospital within the precincts of a town, or in suburbs likely to be built upon.

(b) Remove all general hospital establishments out of town, and from populous suburbs, as soon as circumstances may permit; or, when such removal is not practicable, let all the available ground around the institution be purchased.

(c) Build all general hospitals in the country on areas of ground sufficient to admit of extensions of buildings, and to prevent other buildings from being erected within such a distance as shall interfere with a free circulation of air and with quiet.

(d) Select a mild and dry climate.

(e) Give the preference to a porous self-draining subsoil, and avoid ground saturated with organic matter, especially old graveyards.

(f) Build all hospitals on arches, to admit of a free circulation of air underneath the ward floors.

(g) Let the plan be simple, and have as few closed angles and corners as possible.

(h) Do not provide for more than 120 patients or beds under one double pavilion-roof. If the hospital must contain a larger number of beds, increase the number of pavilions by corridors running between the ends, and no higher than the ground-floor.

(i) Plan any hospital with no more than two flats, containing, in a single pavilion, two super-imposed wards. Provide for convalescents and "casualty" cases in pavilions separate from the ordinary sick.

(j) Provide for no more than 32 beds in a ward (16 on each side), with a window to every two beds.

(k) Let the window-spaces be, as near as may be, in the proportion of one to two of the wall-space. The windows should reach from within three feet of the floor to within one foot of the ceiling.

(l) Wards should not exceed 30 feet in width.

(m) Each bed should have from 1500 to 2000 cubic feet of air-space. In very exposed and airy situations, the smaller cubic space will suffice; but where, from the nature of the ground, there is not likely to be much horizontal external movement of the atmosphere, the larger the internal cubic space is the better.

(n) Trust for pavilion ventilation to open windows and fire-places. Artificial methods are in this climate unnecessary, with proper construction.

(o) Place water-closets, ward-baths, and lavatories at the far-end of a ward, opposite the entrance; and, in addition to ventilating them, cut them entirely off from the ward by a separately-ventilated and lighted lobby.

(p) Restrict the ward-offices to a nurse's-room and scullery, with a lift.

(q) Let staircases be wide, roomy, and thoroughly ventilated up to the roof. Construct the stairs and entrance and entrance-lobbies of stone, and cover them with wood.

(r) Make hospital floors of oak, and the walls and ceilings of pure white polished cement.

(s) Supply hospitals with water at high-pressure, and lay it on, hot and cold, over the whole of the buildings.

(t) All sewers and drains must be outside, and detached from the walls of the buildings. Provide for their ventilation at a distance from the wards, and also for their inspection and flushing.

(u) Provide garden-ground for exercise, with properly drained and gravelled walks, sheltered seats for convalescents, and where practicable, a promenade covered with glass, for bad weather.

(v) Other matters of detail, regarding kitchens, wash-houses, rooms for hospital administration, &c. can be best decided on according to local circumstances; but none of these should ever be under the same roof with the sick.

25. Starting with the principle that the very first requirement in an hospital is that it should do the sick no harm, Miss Nightingale states that the conditions essential to the health of hospitals are principally these: first, fresh air; second, light; third, atmosphere; fourth, subdivision of sick into

separate buildings or pavilions. Let us examine the causes in the usual ward-construction which prevent us from obtaining these and other necessary conditions. The principal are as follows :

- (a) Defective means of natural ventilation and warming.
- (b) Defective height of wards.
- (c) Excessive width of wards between the opposite windows.
- (d) Arranging the beds along the dead walls.
- (e) Having more than two rows of beds between the opposite windows.
- (f) Having windows only on one side, or having a closed corridor connecting the wards.
- (g) Using absorbent materials for walls and ceilings, and, as some will have it, washing floors of hospitals.
- (h) Defective condition of water-closets.
- (i) Defective ward furniture.
- (j) Defective accommodation for nursing and discipline.
- (k) Defective hospital kitchens.
- (l) Defective hospital laundries.
- (m) Selection of bad sites and bad local climates for hospitals.
- (n) Defects of sewerage.
- (o) Construction of hospitals without free circulation of external air.

26. The most approved observations and experiences have sufficiently demonstrated that two floors are enough for convenience of the sick and for purposes of attendance ; and that more than three floors will generally prove prejudicial in many important ways.

27. In our garrison and regimental hospitals at home we generally find an extraordinary number of wards, and of holes and corners, in comparison with the number of sick. In a battalion-hospital, for instance, we shall find eight or ten little bed-rooms (miscalled wards), a little kitchen ; every thing, in fact, on a little scale, like a collapsed French hospital. How much more sensible would it be to have one, or at most two, large wards for thirty to forty sick each, with a small casualty ward ; how much less costly in construction and administration, how much easier the supervision and discipline, how much better the ventilation.

28. "The least administrative form of hospital," says Miss Nightingale, "is the long corridor, with wards of from eight to ten patients, opening off one side. Attendance,—meaning, of course, due attention to the patients, suitably superintended,—becomes almost impossible, especially at night."

29. Whatever the cause of injury to the sick or wounded placed in hospital, the truth and value of the following observation, by the same authority, will be recognised by all who are acquainted with hospitals, whether civil or military : "One insensibly allies together restlessness, languor, feverishness, and general *malaise*, with closeness of wards, defective ventilation, defective structure, bad architecture and administrative arrangements, until it is impossible to resist the conviction that the sick are suffering from something quite other than the disease inscribed on their bed-ticket ; and inquiry insensibly arises in the mind—what can be the cause? . . . I have seen a case of slight fever received into hospital ; the fever to pass off in a week, and yet the patient, from the foul state of the wards, not restored to health at the end of eight weeks."

30. "It is impossible to ventilate a ward in a brick or stone hospital by natural means, when the cubic space is less than a certain amount. Crowded wards are, in fact, offensive with all the windows open."

31. "The cooking apparatus, boilers, &c., if placed in the centre of the kitchen, instead of against the walls, will afford twice the amount of fire-space."

32. "In the Paris kitchens there is a brick erection in the middle of the floor, with iron doors and brass mountings, coppers with covers, places for baking and roasting, &c."

33. "The dressers are against the walls ; the floors are flagged with square flags. This appears to be the most convenient mode of erection."

37. "But it is not so well known that there was but lately scarcely an army hospital which had such a thing as a laundry. The bedding was generally washed by the barrack department; no one appeared to know how. It was done by contract."

39. "A great deal has been said about the communication of 'infectious' disease, both in civil and military hospitals, from patient's linen to washerwomen. . . . Let laundries be constructed with sufficient area and cubic space for each washer, with abundance of water, with proper means of drainage, and ventilation for removing the vapour, and with properly constructed drying and ironing rooms, and we shall cease to hear of washerwomen 'catching fever.'"

40. "But every day brings in fresh inventions, and the reformer is always adopting the good ones. The excellent washing, drying, and wringing machines lately invented, are too numerous to mention; but on the whole, the laundry at Wellington-barracks, which also washes for all the Guard's hospitals and barracks, and the new laundry at Haslar hospital, are the best I have seen."

41. "I do not think that any reliable comparison has yet been made between the French system adopted at the Salpêtrière and Lariboisière hospitals and the English system. The French consists in filtering hot ley through the clothes, which are placed for that purpose in large tubs, with a compartment at the bottom from which the ley is pumped up by machinery, and allowed to flow over the top to the linen, through which it filters into the compartment, to be again raised by the machine. This plan is stated to be the most economical which has been tried in Paris."

42. "There are several good plans in use in British hospitals. The essential characteristic of the Haslar one is boiling by steam, the linen being afterwards placed in a rotating washing machine."

43. "Another method in use at the Wellington-barracks, where the washing of the Guard's barracks and hospital is done, consists in passing the linen through slowly rotating washing-tubs, in which it undergoes a process of waulking by wooden rods. This plan is both economical and effectual."

44. "In almost all the military hospitals in England, it is true, the heavy washing is done, nobody knows how, by contract. But the lighter washing is done in some miserable lean-to, without any arrangement for 'getting-up,' drying, or airing the linen, which is done, if at all, at the ward fire. This is simply destruction to anything which can be called nursing."

45. "The baths should be separated from the pavilions, but connected by the corridor."

48. "A small bath-room for bad cases should be placed adjoining to the water-closets, and also a lavatory."

49. "A lavatory should have a row of white earthenware basins fixed in a stand, with outlet tubes and plugs; each basin should have a hot- and cold-water pipe, and there should not be less than one to each six or eight beds. There should also be in the lavatory a hot- and cold-water pipe, from which the portable bath can be filled."

50. "A scullery—small, but not too small—attached to each ward is, as has been said, essential to order, cleanliness, and discipline. It should be well provided with cold, and if possible, with hot water. No patient should enter the scullery unless sent there to wash-up, &c.; and, as a rule, none should be sent there."

51. "The sink, which should have a partition of its own, adjoining the water-closet, should be a high, deep, large, round, pierced basin of earthenware, above a large hole, with a cock extending far enough over the sink for the stream of water to fall directly into the vessel to be cleansed. This is far preferable to the usual oblong sink."

52. "The scullery sink is of course to be entirely separate, and for entirely separate purposes from this."

53. "In civil hospitals, each nurse should have a small airy room off her

ward and looking into it, so that she can always have it under her command : it is the best for her efficiency, and need not be injurious to her health."

54. "Unless, however, there are facile means of access to another nurse's room, in case of illness, there must be only a day-room for each head-nurse adjacent to her ward. She must sleep at a distance from her ward, and contiguous to the other nurses."

55. "Assistant female nurses are better not employed."

56. "In military hospitals, if orderlies are to sleep among their patients, the per-centage of mortality will be of course raised among them. This was the case at Scutari, where it was very high, though it will never be known how high."

57. "Statistics are, however, not necessary to establish such an obvious fact. The orderlies should sleep at a distance from the wards, or, if sanctioned by military authority, in little rooms adjoining their wards, and they should not take their meals with the patients."

58. "Each orderly should have his locker, each his safe in it, with a key of his own, and he should have his meals there, if the military authorities are not against it."

59. "There should be a press in each ward."

60. "It is a doubtful arrangement to have a clothes-room for each ward. A military hospital should have but one clothes-room, under charge of some man."

61. "Room for storing and issuing dried clean linen, as well as laundry-room, should be provided. Foul linen should be delivered twice daily into the laundry ; and a large box in the scullery is the least bad place for it in the mean time."

62. "The material of the different utensils required for ward service should be settled. The use of glass or earthenware for all eating, drinking, and washing vessels is recommended for its great superiority in cleanliness, and in saving time and labour in cleaning. Tin vessels of certain kinds cannot, by any amount of cleaning, be freed from smell."

63. Recent discussions have imparted much interest to the question of site, especially in connexion with the wants of city populations.

(a) Could sanitary considerations alone rule in this matter, doubtless we should have all hospitals placed in the open country, as near as might conveniently be to our towns and cities, but away from masses of buildings and from dense populations.

(b) But there are other considerations, as the immediate wants and conveniences, the absolute necessities indeed of the poor, which must here be practically met. We must, under such overruling influences, be content to do what can be done.

(c) All physicians and surgeons will agree that the more open, airy, and pure the site of an hospital, the better for its inmates ; but here, as in many other social conditions, we have in fact to deal with the necessities of civilised communities, and we must have certain hospitals of immediate necessity placed within crowded cities.

(d) But, while this fact is admitted, as the result of necessity, we ought everywhere to establish convalescent hospitals, supplementary to, and co-operative with, the central institutions.

(e) But we must remember also that in the perfection of structure, as regards facilities for ventilation and drainage, and in care as to the cubic space allotted to each patient, will everywhere be found the best securities against errors and deficiencies in respect of localities, whether in town or country.

(f) Strange to say, we have in the hospital Lariboisière an example of a structure of unequalled excellence, with a good town site, all rendered unsuitable and consequently unhealthy, by a perversion of arrangement. Lariboisière was constructed for natural ventilation, but this was not deemed sufficient ; so, pure air has been denied to the patients, and a heated and im-

pure air has been forced into the wards to stifle and sicken them, and to augment their mortality.

(g) It is conduct such as this, in discharge of a public trust, which gives colour to and occasion for the suggestion of Ponteau: "Are hospitals, then, more pernicious than useful to society?"

(h) One circumstance has been much overlooked in discussions as to the construction of hospitals, and of their usefulness—namely, that the disadvantages of massing sick in very large apartments, however unsuitable on various accounts, and in many cases, bear no comparison with those which are always encountered in the miserable habitations of the poor, both in town and country;—the fact being that many of the defects of even the worst hospitals may be in great part remedied by means of ventilation, and by providing day-wards, and by the establishment of convalescent hospitals.

Lastly. The convenience of the patient must be a point of first consideration, so as that the hospital may be completely accessible to the ailing, the diseased, and the maimed amongst the poor; so as to secure also to them the services of physicians and surgeons in large private practice, thus assuring at the same time the best medical science from the heads of the profession, together with the best means for the establishment of great medical schools.

VENTILATION, LIGHT, AND CUBIC SPACE.

1. The first and most important consideration in constructing and arranging hospitals is to secure a free supply of pure air outside and inside the building.

2. The air must be moving air in mass. Plan the building, therefore, so as that the sun-light may strike as large a surface of it as possible, and so that the air may move freely over the whole external surface.

3. In Scripture the atmosphere is termed "the breath of life," as indicating the vital properties of pure air. So life-giving is pure air indeed, that we must have it in excess of our actual wants, if we would insure that what we are inhaling may not be corrupted by the consumed air which we have exhaled; for, be it remembered, that no kind of impurity of air is more injurious to health than the impurity of air expelled from the lungs. Ample cubic air-space is both important and necessary; but it alone will nowhere prove sufficient for health, without provision for the constant removal of the exhalations from the lungs and skin of the sick.

4. For thousands of years the natives of India have regarded purity of skin as obtainable only through the rinse of the river stream, or through the imitation of it in the bath-room by a constant stream of clear water poured from a vessel—the same water not applying to the skin twice. If we would enjoy a perfect respiration, with consequent purity of the blood, we must secure the same kind of rinsing or cleansing, by a constantly succeeding supply of pure air for the supply of the lungs.

5. The motion of the air in any room should never exceed the velocity of two feet and a half per minute, and it should not at any time be much below this rate.

6. There must be no stagnation. A court, with high walls round it, does one thing with certainty—it stagnates the air, and renders it unfit for respiration.

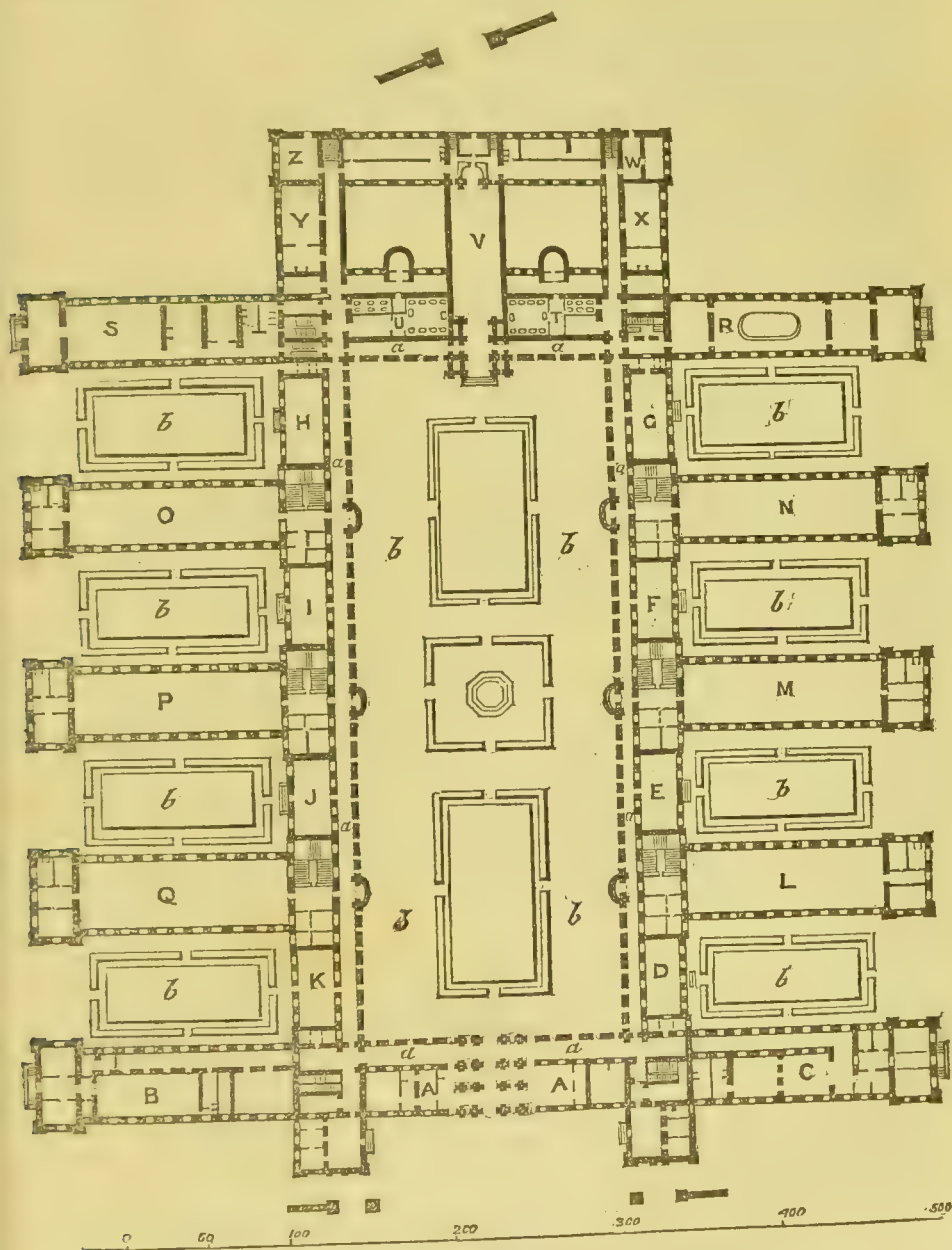
7. All closed courts, narrow *culs-de-sac*, high adjacent walls, closed angles, over-shadowing trees, and other obstructions to outer ventilation, should be sedulously avoided at whatever cost.

8. There are certain arrangements of buildings at present occupied for hospital purposes which ought to be carefully avoided, whether in town or country.

9. It may be considered certain, that, wherever such arrangements exist, injury to the sick is so constant that, were it practicable, all the angles should be opened out, in order to admit the free circulation of air.

10. The most simple form of structure for insuring ventilation and light is to build hospital wards in a straight line, with windows on both sides, *i. e.* back and front—the lengthway of the ward being the lengthway of the building, and the administration in the centre.

11. By such an arrangement as the above, however, no more than four wards could be obtained, if the building were two stories high. For small hospitals intended only to receive 120 sick, this plan will prove efficient and economical.



HOSPITAL OF LARIBOISIERE, PARIS, 612 BEDS.

A Offices.

B Kitchen on the ground floor. On the 1st floor, lodgings of the officers; on the 2d floor, dormitories for male attendants.

C On the ground floor, pharmacy; on the 1st floor, lodgings of the officers; on the 2d floor, rooms of the resident pupils.

D E F G H I J K Dining rooms, &c., one story high; now disused as such.

L M N O P Q Buildings for the sick, three stories high.

R Ground floor, washhouse; on the 1st floor, linen store; 2d floor, dormitories for female attendants.

S Sisters' Rooms. T U Baths. V Chapel.

X Y Amphitheatre.

Z Manège and stores.

W Stable and dead house.

a a a a Corridor one story high, with open terrace above, running round the buildings, and connecting them.

b b b Gardens.

12. The direction of the axis of such a building should be from north to south, a little inclined to the east, so as to secure the sunshine on both sides every day of the year, and to protect the wards from the N.E. winds.

13. One staircase will suffice for an hospital such as this ; and if it were carried from the bottom to the top of the building, and ventilated above the roof, it would entirely cut off one set of wards from the other, and thus prevent the possibility of any intermingling of foul air.

14. A much better arrangement is that in which the wings are entirely detached from the centre, and connected with it only by an open corridor on the lower floor. This is the plan adopted in the great military hospital at Vincennes, and is a very good one for hospitals of a certain size, for the open angles permit air to circulate freely round the building. All these plans, however, have the disadvantage of not admitting extension beyond a certain limit.

15. The only plan which allows as much extension as can be necessary in any single hospital, up to (say) a thousand sick—beyond which hospital management becomes very difficult—is the plan adopted in the hospital of Bourdeaux ; or, still better, that of the Lariboisière at Paris, of which the plan will be found on the preceding page.

16. In that fine, though not perfect, hospital, each block, containing 102 sick, constitutes a separate hospital. There are six of these blocks, which are arranged parallel to each other on two opposite sides of a square ; and there are four blocks containing the administration and other offices.

17. All the blocks are joined together by a glazed corridor along the lower floor, and by an open terrace above, for convalescents taking exercise. In such a building, for the sake of sun-light, the axis of the wards should run nearly from north to south, and the distance of the blocks from each other should be about twice the height of the side walls.

18. As regards immediate ventilation, the important considerations are—the quantity of air required in an hospital, and how best to renew it.

19. To make ventilation equable and agreeable, the windows and other apertures must be directly opposite to each other, of the same dimensions, so as to admit and emit an equal volume of air, through an equally free communication with the external atmosphere. Inattention to this simple rule has often defeated arrangements otherwise excellent.

20. Oil-lamps are to be preferred for lighting of wards, as gas produces glare, and is apt, through defects in the pipes and burners, to leak into the ward.

21. The great and constant movements going on in the atmosphere prove that the amount of change which nature has provided for healthy existence is unlimited. The test of ventilation in a sick ward is the comparative freshness or impurity of the air. The interesting experiment of Lariboisière appears to prove that about 4,000 cubic feet per hour are required to insure this.

22. There are two ways of maintaining the freshness of a ward : First, by so constructing a building that Nature will renew the air, if left to herself, which is by far the best plan ; secondly, by artificial ventilation—never to be used except as a *pis aller*.

23. If an hospital be badly planned, or the fuel dear, artificial ventilation comes into beneficial operation, for it admits of economical warming ; but it never *freshens* a ward like pure natural air from without.

24. It is quite certain that a condition of ward-air is secured by open windows, and by open fire-places for warming, which is never obtained by the best ventilating machinery, especially if warm air be thrown in by it. Every observant medical officer and nurse knows this : the air from without is better oxygenated, and perhaps contains more ozone.

25. Architects must therefore well consider how in every corner of wards, passages, and staircases, air is to be kept constantly *flowing*—not air passing in a stray or in a strong current, but air gently moving.

26. Wards must be made of a certain height and breadth, having a window for every two beds, the windows being exactly opposite to each other. As regards complete ventilation, the effects of angles in retarding an even flow of air has not been sufficiently considered. Direct experiment, made in the wards of the Lariboisière, has proved that the amount of air circulating along the centre of a ward is two or three times as great as near angles.

27. Such a result might have been inferred. But the important practical point seems never to have been comprehended, that the difficulty of ventilating a given cubic space, occupied by sick, bears a direct ratio to the length of the corridor, and to the number of wards into which that space is divided.

28. Unnecessary rooms, angles, or cupboards should be omitted: there should be no dark corners in any part of an hospital ward; every recess or angle not easily overlooked, being as injurious to hospital discipline, as it is to hospital ventilation. Transverse or horizontal ventilation may be rendered perfect by the means already indicated; but in seasons of protracted calms, in the heats of summer and autumn, and in tropical climates, means should be prepared for securing vertical ventilation, by means of turrets in the roofs of hospitals and barracks.

29. Each pavilion should have a staircase, wide, roomy, well lighted and ventilated from above; the gradients of the steps not rising above five inches to twelve inches tread, in order that patients may ascend and descend with facility.

30. There should be as little passage-space as possible, and none of it should be dark.

31. Architects have not sufficiently appreciated the great difference between the air-wants of wards constantly occupied by sick and wounded, and those of apartments used as dormitories during so many hours only, by persons in health, and that a provision which may be sufficient for the one falls far short of the necessities of the other.

32. Mr. Robertson of Manchester, in his excellent reports on the "Construction and Ventilation of Hospitals," assures us that the insalubrity of our hospitals arises mainly from two causes;—first, the difficulty, owing to faulty construction, of securing a free circulation through the wards, and continued renewal therein of the external atmosphere; and, secondly, the intimate connection existing between the different wards in each story, by means of doors and passages, and between the different stories by inside stairs—an arrangement which favours the rapid diffusion over the house of the foul air continually being generated in every one of the wards, and the creation consequently of an hospital miasm.

33. But all the evils of defective ventilation were well known to our older hospital staff, civil and military, and are admirably described by Pringle, Cullen, Lind, Rush, Robert Jackson, Smith, &c. &c.

34. In remarks concerning circumstances of distress not within the provisions of hospitals, with the regulations of the Samaritan Society, instituted in London in 1791, we find the following observations:

35. "The air may have its purity, and consequently its uses, affected in several ways;—by what diminishes its immediate fitness for respiration; by what lessens its capacity to receive in due quantity that which is excreted from the lungs and skin; by what destroys, or abridges, that which should be received by the absorbents of the lungs and skin; and by what, in its own nature, would prove noxious, if absorbed. In these ways also various combinations of mischief may arise."

36. "To the last distinction animal effluvia must be referred. But infinite are the depravations of the air, under the heads stated, graduating, from the slightest degree of each, up to the power of producing death instantaneously."

37. "Attention being paid to the cardinal object, AIR, hospitals possess advantages, adapted to the condition of sick and hurt persons, superior to what can be equalled by many situations in life. Informed persons should, therefore, discourage the prejudices that are sometimes entertained by the

lower orders, against these establishments; in support of which they will not unfrequently resort to invention."

38. Dr. Percival of Manchester, writing to Mr. Aikin, in 1771, says: "AIR, DIET, AND MEDICINE, are the three great agents to be employed in preventing and correcting putrefaction and contagion in hospitals." There he rates medicine as the third power.

39. Pringle declares that "air corrupted by putrefaction is, of all other causes of sickness, the most fatal, and least understood; for these destructive steams work like a ferment, and ripen all distempers into a putrid and malignant nature. But the air in hospitals and crowded barracks, close transport-ships, and in a word, from every place where air is so pent up, not only loses a part of its vital principle by frequent respiration, but also is corrupted by the perspirable matter of the body, which, as it is the most volatile part of the humours, is also the most putrescent: hence it is that, in proportion to the nastiness of such places, to the number of dysenteries, and of foul sores, but above all, of mortifications, a malignant fever is both frequent and fatal."

40. The instructions of Donald Monro, the army Surgeon, for the ventilation, cleanliness, and order of the military hospitals of his day (1760-1780), would do honour to any medical officer of our time; and Brocklesby (1756-1763), speaking of his experiences in preserving the health of seamen and soldiers, distinguishes "above all things fresh air."

41. As regards the general principles, and the need for ventilation, there is nothing whatever known to us, in the middle of the 19th century, which was not well understood by Pringle, Monro, and Brocklesby, in the middle of the 18th century. The real difference in our favour is in the aid we derive, practically, from the influence of public opinion, and from the power of the press which represents it.

42. Dr. Rollo of the Artillery states (1801) the following points as necessary in an hospital:

1. A free ventilation and regular temperature.
2. Ready means of cleanliness.
3. Amusement for patients, by giving them airy and gay prospects, with pleasure-grounds.
4. A ready means for separation of the sick, and for preventing the spreading or progress of infectious diseases.

He adds that "cleanliness of the patient, and of every thing about him, is indispensable. This and ventilation are the two first and most essential objects in hospital management."

43. To illustrate his subject, Dr. Rollo says that, in 1789, several men of the artillery at Woolwich were seized with a severe form of continued and relapsing fever. These men were found to have occupied beds "different from the rest of the barracks, having hammock-bedding. The hammocks were rolled up tightly every morning the moment the men rose, and they were unloosed when they went into them at night; and this time we had so much and so constant rain, that this bedding had not been aired, or opened for a single day, for at least two months. The hammocks were with their bedding examined, and the moment they were opened, a very peculiar nauseating smell was perceptible. Steps were immediately taken, and no further mischief took place. Here an infectious fever evidently arose from the confinement of the effluvia of a man's own person, in a time of about two months."

44. Having explained thus far the principles and practice of ventilation as applicable to hospitals, I would add a few observations on LIGHT—a subject of the greatest importance, but one surprisingly neglected by all classes of our teachers, whether lay or professional.

45. Of all the elements which play a high part in the material universe, the light which emanates from the sun is certainly the most remarkable, whether we view it in its sanitary or scientific relations. It is, to speak metaphorically, the very life-blood of nature, without which every thing material would fade and perish.

46. "It is well known," says Dr. Priestley, "that *without light* no plant can thrive; and if it do grow at all in the dark, it is always *white*, and in all other respects in a sick and weakly state."

47. But the direct influence of light over the phenomena of life will not be found limited to the vegetable kingdom, or to the lower races of the animal world. Organisation and life exist only at the surface of our planet, and under the influence of light. Vegetables and animals near the surface of the sea are brilliantly coloured; but they gradually lose the brightness of their hue as they descend, until the animals of the lowest zone are found to be nearly colourless. Those depths of the ocean at which an everlasting darkness prevails are the regions of silence and eternal death.

48. Man in his most perfect type is doubtless to be found in the regions of the globe where the solar influences of light, heat, and chemical rays are so nicely balanced. Under the scorching heat of the tropics man cannot call into exercise his highest powers. The calorific rays are all-powerful there, and lassitude of body and immaturity of mind are its necessary results; while in the darkness of the Polar regions the distinctive characters of our species almost disappear, in the absence of those solar influences which are so powerful in the organic world.

49. Dr. Edwards maintains, however, that in climates in which nudity is not incompatible with health the exposure of the whole surface of the body to light will be very favourable to the regular conformation of the body; and Baron Humboldt affirms of the Chagmas that "both men and women are very muscular; their forms are fleshy and rounded. It is needless to add that I have not seen *a single individual with a natural deformity*. I can say the same of thousands of Caribs, Muyscas, and Mexican and Peruvian Indians, whom we have observed during five years. Deformities and deviations are exceedingly rare in certain races of men, especially those who have the skin strongly coloured." The development of the perfect form of certain of the lower animals, it is well known, depends on light.

50. The influence of the sun's rays in deepening the colour, or in giving a brown tint to the skin, seems to be more due to the light than to the heat of the sunbeams; for the parts of the skin covered by the clothes, though kept thus hotter than the parts exposed, do not undergo this change.

51. The pale visage and enfeebled vitality of those who live much in obscure apartments, in prisons, and in mines, are well known; and though probably the most violent symptoms that characterise the anæmia of miners, in which the skin assumes a yellowish waxy hue and the lips become bloodless, be chiefly due to breathing a vitiated atmosphere, yet some influence is certainly attributable to want of light. The anæmia of persons long confined in dungeons has often been remarked, and was lately described as strikingly exemplified in the person of Caspar Hauser, the young man whose mysterious birth, confinement, and assassination have hitherto baffled conjecture.

52. But, recurring to the influence of the sun's rays on growth, "we see," says Dr. Edwards, "that the action of light tends to *develop the different parts of the body in that just proportion* which characterises the type of the species. This type is well characterised only in the adult. The deviations from it are the more strongly marked, the nearer the animal is to the period of birth."

53. If light thus develops, in certain races, the perfect type of the adult who has grown under its influence, we can hardly avoid the conclusion drawn by Dr. Edwards, "that the want of sufficient light must constitute one of the external causes which produce those deviations in form in children affected with scrofula;" and the more so, that this disease has been observed to be most prevalent in poor children living in confined and dark streets. Following out the same principle, this distinguished physiologist infers that, in cases where those deformities do not appear incurable, exposure to the sun in the open air is one of the means tending to restore a good conformation.

54. If the light of day then, freely admitted into our apartments, is essential to the development of the human frame, physical and mental; and

if the same blessed element lends its aid to art and nature in the cure of disease ; it becomes a personal and a national duty to construct our dwelling-houses, our schools, our workhouses, our churches, our villages, and our cities upon such principles, and in such styles of architecture as will allow the life-giving element to have the fullest and freest ingress, and to chase from every crypt and cell and corner the elements of uncleanness and corruption which have a vested interest in darkness.

55. If it is important to obtain a proper illumination of our apartments when the sun is above the horizon, it is doubly important when he has left us altogether to a short-lived twilight, or consigned us to the tender mercies of the moon. In the one case it is chiefly in ill-constructed dwelling-houses and large towns and cities, where a dense population, crowded into a limited area, occupy streets and lanes in almost absolute darkness, that science is called upon for her aid ; but in the other we demand from her the best system of artificial illumination, under which we must spend *one-third of our lives*, whether they are passed in the cottage or in the palace, in the open village or in the crowded city.

56. As regards the lighting of hospitals, window-blinds can always moderate the light of a well-lighted ward ; but the gloom of a dark ward is irremediable. We *can* generate warmth, but we cannot generate daylight, or the purifying and curative effects of the sun's rays.

57. Dark barracks and barrack-rooms with northern aspects, it is well known, will furnish a larger amount of sickness than light and sunny rooms.

58. The danger of through ventilation is much exaggerated ; for, excepting in a few well-known instances, the risks are hardly worth estimating, as compared to the benefits of the life-spring to the sick—fresh air. Patients in bed are not generally inclined to catch cold.

59. Catching cold while in bed follows the same rule as while we are up. If the atmosphere be foul, with the lungs and skin oppressed, and unable to relieve the skin by depuration, then a draught may bring a chill ; but this is the fault of the foul air, not of the fresh.

60. As regards temperature, trifling variations are in general rather beneficial than otherwise ; and a cooler atmosphere at night acts rather as a tonic.

61. It is much to be regretted that of the influence of light upon the human frame and upon the mind in health and disease, so little should be known to us ; but let us hope that physicians and physiologists may be induced, by the importance of the subject, to avail themselves of their numerous opportunities in hospitals, prisons, and asylums, to study this great subject.

62. Our hospital architects in England do their best to shut out our rare and imperfect sunlight, and to keep pure air out of the wards as much as possible ; while they provide for the sick being so arranged that the effluvium must pass over a succession of beds before it can escape.

Postscript. Having presented to the reader an exposition of natural ventilation as arranged in the modern French hospitals, I will briefly state the plan and object of Mr. Mackinnell's invention ; for it also purports to ventilate all kinds of buildings and all kinds of apartments through an entirely natural process, and by means, indeed, of a law of nature.

(a) This latter plan is recommended to us on the score of its simplicity and ready applicability to all kinds of areas, whether opening to the atmosphere vertically by the roof, or only horizontally by the external walls, and by the manner in which it equalises the waste and repair, without ever allowing the air to become deteriorated, or to be thrown into commotion by contending currents.

(b) The apparatus consists essentially of two tubes, the one placed within the other, with an annular space between them, and both opening freely into the external air. The internal tube, destined to carry off the vitiated air, is placed in the chamber to be ventilated, with its downward opening near the ceiling, towards which the air, from its superior lightness, naturally ascends.

(c) The annular space is intended to supply the waste, and accordingly the external air, which is denser and heavier than the vitiated air, naturally passes through it into the chamber.

(d) Were it left free, it would form an injurious descending current ; but this is ingeniously obviated by a projecting flange, which, checking the entering air in its downward course, causes it to spread equally and horizontally over the whole area, without producing any of those sudden fluctuations of temperature, which, in other modes of ventilation, have been felt at once unpleasant and unsafe.

(e) Over the escape-tube there is placed a hood, so contrived as to prevent the admission of rain. This tube would be sufficient to allow all the foul air of a room to escape from it ; and if doors and windows were kept open, there would be a constant supply of pure air.

(f) Draughts have to be avoided in any efficient scheme of ventilation, otherwise it would be an evil in place of the greatest good ; but Mr. Mackinnel has a simple and effective method of supplying fresh and pure air, while he takes off that which has been consumed and corrupted.

(g) Attached to the outer tube, or that which envelopes, so to speak, the escape-tube, he has an arm or arms which pass at right angles, or by any other convenient direction, to the outer air ; and while the inner tube is causing an upward and outward current, these arms lead the exterior and pure air into the concentric opening formed between the two tubes, where there is a constant downward current.

(h) The flange already spoken of spreads the air in a thin film across the ceiling of the apartment, whence it falls, in consequence of its greater gravity, in imperceptible columns, like rain, down through the body of air in the chamber.

(i) The whole aim of this apparatus is to give concentrated play and force to the natural action ; and in this aim it seems completely to succeed, the inner tube drawing off like a chimney all the foul and heated air within, and the outer tube, with the air-ducts passing from it at right angles to the outer atmosphere, affording a passage to the pure air which flows to the vacuum thus created.

(j) Such is the simple, safe, and scientific means of the inventor, for the supply of an effective ventilation to every description of building. It is perfectly natural in its action, in which we perceive an absence of every thing like forcing. On the contrary, fresh air is here introduced in a natural and imperceptible manner, and distributed over all areas, so as not to offend the most delicate lung or skin.

(k) While it has always been a most easy matter to produce strong currents of air, it has hitherto been found most difficult to devise means by which vitiated air should have an easy and certain escape, while the pure air should find an equally ready means of entrance ; the egress and ingress being sufficient, yet so constant and imperceptible, as not to indicate any remarkable atmospheric action.

(l) This practical efficiency in ventilation appears to have been brought about by Mr. Mackinnel in an easy and cheap manner, capable now of being estimated by the rigorous test of the result.

(m) All descriptions of buildings, private and public, have been supplied with this apparatus, and always with the same results, as evidenced by numerous and unquestioned testimonies.

(n) The scheme aims at the attainment of its object by aid of a natural law ; and with its good properties it has not hitherto been found to blend any evils, which is saying much for the inventor.

(o) In Merchant's Hall, Glasgow, when so full that nearly a thousand persons were assembled in it, two ventilators were found, in mid-winter, "amply sufficient to keep the air sweet and wholesome ;" the doors and windows being meanwhile kept closed.

(q) "Such was their efficacy, that no perceptible change could be dis-

covered between the air in the hall, when full of people, and when it was emptied."

(r) So also, when applied to stables and a veterinary hospital, the air was fresh and free from all offensive and ammoniacal gases; while the horses were observed to recover from their respective diseases much more speedily and effectually than before.

(s) One peculiarity of Mr. Mackinnel's system remains to be noticed. It will not act, and there is no need for its action, in empty apartments having the temperature of the air inside of the same scale with the outer atmosphere. But when, in an occupied area, through the ascent of the warmer and lighter air consumed in expiration, the inside temperature becomes raised above that outside, then the processes of escape and admission begin; and they both proceed in exact and regular proportion,—the one rushing out, and the other pouring and spreading inward, after the gradual and imperceptible manner already described, and as regulated by the demand for pure air of the area inhabited. To ventilate the corners of apartments, excepting by some such action as this, would appear next to impossible, through natural means.

Finally, the task Mr. Mackinnel has to perform is this: to ventilate all kinds of apartments, and enable the inmates to receive the amount of air requisite for health, thus counteracting all kinds of structural defects in private and public buildings. If he can do this, and he appears to have done it, he will indeed have achieved a great victory, and confer a benefit on the public beyond estimation. If his system can do all this, it fulfils the most important purposes. It corrects the hitherto irremediable errors of structure in our barracks and hospitals—errors not to be corrected in any other way except by rebuilding; it renders barrack-rooms and wards of hospitals habitable which were before not habitable.

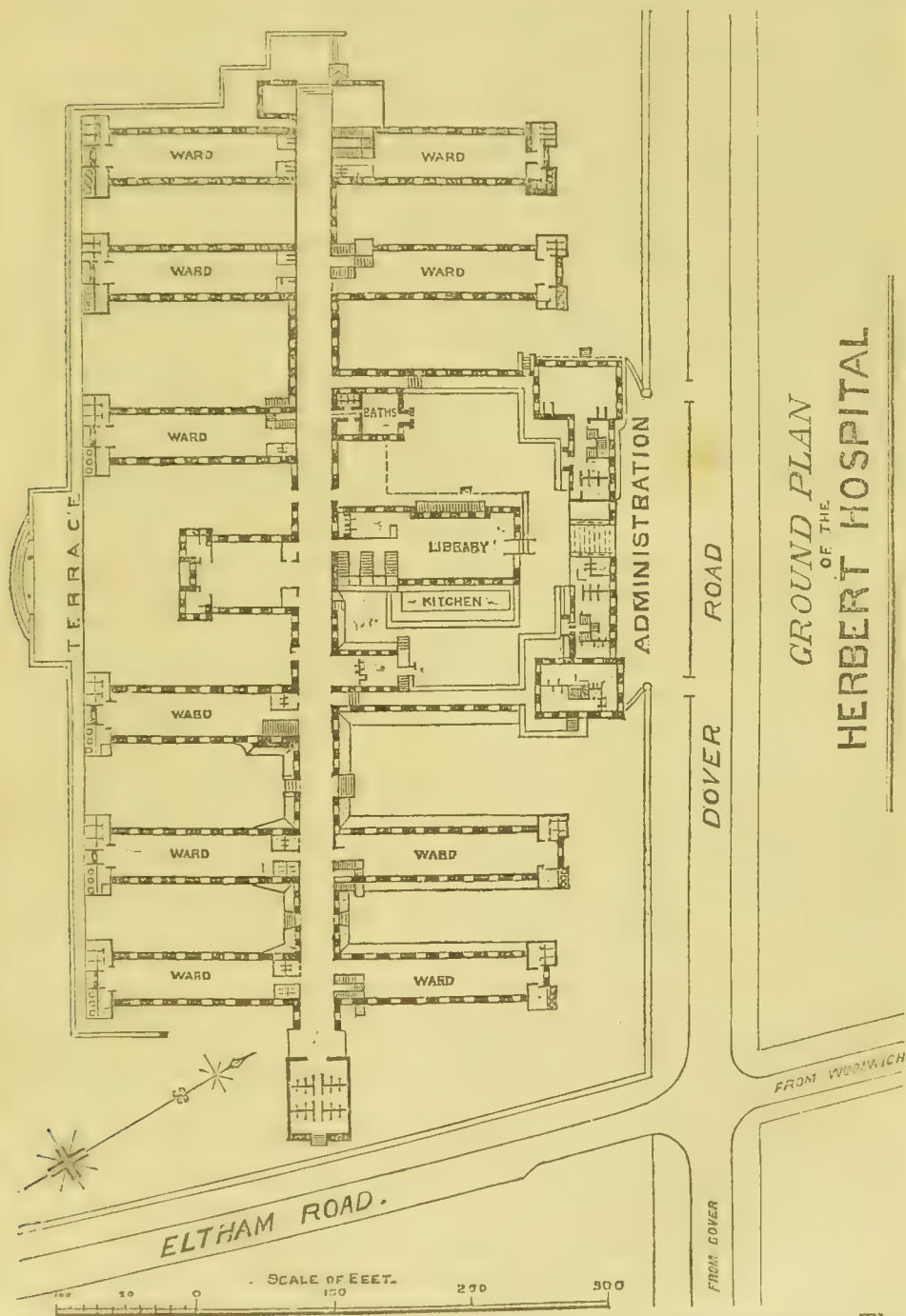
I hope that the foregoing remarks on the ventilation of hospitals may not be regarded by the reader as too long or too minute in their details. The subject is of the last importance, and the profession in a general way knows its importance. But there is a vast difference between the general perception of a fact and the actual realisation of its import; and this is my excuse for the length of the present section.

There are many important objects interesting to society which present themselves in contemplating the construction and the professional concerns of hospitals; and, as in commercial and other affairs of life, they will best be understood by men who have most directed their attention to the subject.

Since the above was written, an improvement upon all hospitals hitherto constructed has been made in our own country; and I cannot do better than present the brief statement of its advantages from the authority so often quoted in this essay.

"But," says Miss Nightingale, "all the advantages of the Lariboisière and Vincennes plans, without any of their disadvantages, and with greatly improved sanitary arrangements, will be realised in the new Herbert Hospital, now under construction at Woolwich. This, when completed, will be by far the finest hospital-architecture in the United Kingdom, or indeed in Europe. It consists of four double and three single pavilions, with the ends in the air. All the wards are raised on basements; those at the lower end of the ground are so lofty as to afford excellent accommodation for the museum, medical officer's room, board-rooms, and stores. There are only two floors of wards to each pavilion; and the distance between the pavilions is double the height of the pavilion, measured from the floor of the lowest ward. Every ward has a large end-window, commanding beautiful views; and the ablution and bath accommodation, together with water-closets, is placed in the free atmosphere at the end of the wards. Each large ward contains from twenty-eight to thirty-two beds, with windows along the opposite sides,—one for every two beds; and each ward has a nurse's room and scullery.

"Unfortunately, the army-regulation number of cubic feet per bed has limited the height of the wards to fourteen feet. There is a convalescent day-room in the central pavilion. The kitchen is in a basement; also in the centre, over it, there is a library; and over the library the chapel. All the



GROUND PLAN
OF THE
HERBERT HOSPITAL

administrative offices and quarters are in a separate block in front. The axis of the wards is a little to the east of north; and each side will receive the sun's rays during some part of the day. At one end of the hospital there are separate lunatic wards with separate offices. At the other end is the operation-theatre, with a few small wards for special cases.

"The total accommodation is for 650 beds, in seven detached buildings, all connected together through the centre by a corridor one floor in height, with a basement corridor beneath, through which the whole service of the hospital, so far as regards the conveyance of diets, medicines, coals, and the removal of dust and foul linen, will be carried out. This is effected by a system of lifts and shoots; and the result will be, that the usual bustle observed in hospital passages will be altogether avoided.

"This hospital embodies the great administrative principle of an entire separation between what is immediately necessary for the sick and what is not so, and yet without interfering with the efficiency of the administration. Over the corridor is an open terrace, to which convalescents in the first-floor wards will have easy access in fine weather; and the covered corridor below will be available for exercise in wet weather.

"Each ward is $26\frac{1}{2}$ feet wide and 14 feet high; and each bed has 93 to 97 superficial feet, and 1200 to 1400 cubic feet. The walls will have a polished light-coloured surface. It is intended to warm the wards by two open fire-places along the centre of the wards, the flues being carried under the floor, and used for warming the air admitted to the wards. The floors are of iron beams, filled in with concrete, and covered with oak boarding. The whole will be fire-proof, and the sick in the lower wards will not suffer from noise in the wards overhead. Hot and cold water will be laid over the entire building; and the water-supply, which is taken from chalk, and hard, will be softened by the lime process before being transmitted to the hospital."

HYGIENE OF HOSPITALS.

The hygiene of hospitals comprises, the proper selection of localities, attention to suitable construction, ventilation, admission of light, supply of pure water, with means of flushing drains and sewers, proper diet and clothing, a just distribution of sick, personal hygiene, and personal attendance, &c.; in short, attention to all those well-known measures of prevention of disease, and of aids to cure, the suggestions of experience in hospital management, with which physicians and surgeons are now happily becoming better acquainted than was formerly the case.

2. Medicine has during long ages been in an unnatural condition of reversal or of transposition; and hence the art of healing has been more present to the minds of the professors of physic, and of the public consequently, than the science of hygiene. So highly, however, has hospital hygiene been appreciated in France for some time past, that hospital construction has there recently attained nearly to perfection. We are now following the good example, and may soon hope to equal, if not surpass, our neighbours.

3. Surgeons, too, while they have so frequently disputed about modes of performing surgical operations, have but seldom occupied themselves with an investigation of the causes of surgical fevers and other hospital diseases, producing annually, before and after surgical operations, so large a mortality in our charitable institutions.

4. The prevalence of surgical, puerperal, typhus, or typhoid fevers; erysipelas, pyæmia, sloughing, or profuse suppurations in wounds or ulcers, may every where be regarded as a sure proof of ill-construction and defective ventilation in hospitals; while the rapid healing of wounds and sores, the absence of erysipelas and low fevers may, on the contrary, be received as indices of excellence of plan, arrangement, and discipline.

5. Every patient who is placed on the operating-table incurs a certain amount of risk of death; but when the operation is severe, and the hygienic conditions unfavourable, the risk incurred is as great, or even greater, than that incurred in severe military enterprises, as battles and sieges. How careful and continual should therefore be our endeavours to secure the sanitary integrity of our hospitals, so as thus to aid by our best means the efforts of the physician and surgeon.

6. Miss Nightingale, referring to the organisation for sanitary purposes, government, and supply in hospitals, says: "The first is really the most important. The sick at Scutari might have been loaded with medical comforts, attended by the first medical men of the age; and under sanitary conditions such as there existed, they had not a chance."

7. Referring again to the hygiene of hospitals, civil and military, the same authority adds: "The distinction between personal and public hygiene must not be overlooked. It is acknowledged in civil life. The officer of health of towns," who was first proposed by Mr. J. R. Martin, "does not do the work of the physician or surgeon; and, on the other hand, you do not send for your physician or surgeon to drain your streets."

8. "Had an officer of health," as proposed again by Mr. Martin, "been attached to the quarter-master-general's department at the base of operations, who would have put to rights those buildings before we occupied them, how much life would have been spared!"

9. "This officer should have full powers, through the quarter-master-general's department, to see, 1. to the draining of sites; 2. to the sewerage; 3. to the cleansing of outskirts; 4. to ventilation; 5. to water-supply; 6. to lime-washing and cleanliness of the buildings; 7. to the allotment of cubic space; 8. to the sanitary conduct of burials;" and so also in civil life.

10. "There is here quite enough for one man to do. There is no more need for this administration of hygiene of buildings to clash with that of the personal hygiene of the patients, which must always be left to the medical officers, than in the precisely analogous case of civil life, where no man ever thinks of confounding the two."

11. "Before and after the works executed by the Sanitary Commissioners, begun in March 1855, the hospitals at Scutari bore a similar sanitary difference to that which the gaols of the last century, which were pest-houses, did to Colonel Jebb's prisons of 1857, the most healthy buildings in existence."

12. "The sanitary works were begun, and, after their completion, the mortality fell to less than one-sixth of what it was when the barrack and general hospitals were first occupied together in October 1854, and to one-nineteenth of what it was in February 1855. What other inference can be drawn from such statistics and conditions but this, that, had nothing been done, before four weeks were out, or as soon as the hot weather set in to give fresh strength to the seeds of epidemic disease buried among us, the hospital population of the Bosphorus would have been swept from the face of the earth, and there would have been no one left in those lazaret-houses to tell the tale! Civil life is full of similar lessons."

13. "I am bound to say that the military hospitals I have seen in England, Portsmouth, Chatham, Brompton, are almost as much in want of certain sanitary works as Scutari."

ADMINISTRATION. Mr. Fonblanque observes, that "it is not the *personnel*, but the *morale*, upon which a sound administrative system hinges; a system based on the personal integrity of its agents." The objects and ends to which every thing in an hospital should tend, are—economy in expenditure, ease and expedition in labour, and exactness in the results. These great objects are attained by regulating the order of labour, by removing superfluous servants, whose presence obstructs real labour, and by dispensing with useless labours which consume precious time, obstructing and postponing the results; by the establishment of a system, in fact, in which economy and humanity shall be equally respected. The success of the treatment of the sick in hospitals depends less on the remedial means than on the care, the vigilance, the regularity, and the order with which service is performed. Without that order, the sick run the greatest risks, even in the hands of the most able and the most practised.

2. By a perfect administration—by proportioning the number of trained servants to our wants—by regulating their various functions—by uniting

economy with success, in fact—we may in some measure overcome imperfections in structural arrangements. But, on the other hand, when administration is ill-ordered, and the hospital building ill-constructed, it is death to the inmates. Borne down by such overwhelming disadvantages—odds of our own creation—the highest talents and the best exertions of the physician and surgeon are set at nought.

3. Having made ample provision for the admission of light, and for securing freedom of ventilation, our hospital arrangements should, as stated, comprise the greatest economy in administration, consistent with the rapid healing of wounds, and the perfect recovery of the sick.

4. There should be facility of superintendence and nursing—the wards being of such a size, and so arranged, that the head-nurse may have all her sick under her eye at once: this is especially necessary for night service.

5. A nurse may adequately superintend a ward of from thirty to forty patients. But, if we are to be guided by the results of recent experience in hospital building, we should say that a ward of thirty-two sick, or thereabouts, is, upon the whole, the best for sanitary reasons.

6. A convenient arrangement of lifts, and the laying of hot and cold water all over the building, economise attendance—certainly as much as one attendant to every thirty sick.

7. Provided always that the medical staff be well chosen, it may be said of all hospitals, civil and military, whether we regard the credit of the institution, or the welfare of its inmates, that the less interference—the more the executives are trusted by the governing power—the better.

8. By the exhibition of a just confidence the governing body will secure in the medical staff that chastened zeal which has useful result for its object, and avoid that greatest curse of intermeddling—a cold performance of duty. Under a wise course of treatment we shall secure a cheerful system of subordination, and a progressive responsibility, without which no hospital, whether civil or military, can prosper. To unite men of like dispositions and pursuits, and make them coöperate for the public good, is to turn their talents to the greatest advantage.

9. In all establishments the improvement of the medical profession should be held systematically in view; and should any medical officer forfeit the confidence of the governing authority, he should at once be withdrawn. There ought never to be any medium between confidence and the want of it.

10. Miss Nightingale—always our highest authority—gives the following heads, in general terms, for the government and supply of a military general hospital:

11. *Government.* One executive responsible head is what is wanted in a military general hospital, call him governor, commandant, surgeon-in-chief, or what you will; and let it be his sole command. Let him be military, medical, or civilian officer, as the possession of administrative talents point out a man for the work. The departments should not be many.

(a) A governor, solely responsible for every thing but medical treatment.

(b) A principal medical officer and his staff, relieved of all administration, and strictly confined to his professional duties.

(c) A steward, who should fulfil the duties of purveyor, commissary, and barrack-master, and supply every thing, subject to the governor.

(d) A treasurer, who should be banker and pay-master.

(e) A captain of hospital attendants, who should undertake the direction of the cooking, washing, care of hospital furniture, and government of orderlies.

12. All these officers must be appointed at home by the War Department. According to this plan, the governor would cumulate the functions of quartermaster-general and adjutant-general, and therefore the sanitary officer mentioned before would be attached to him instead of to the quartermaster-general.

13. The governor would be solely responsible for carrying out the works advised, and for engaging the labour requisite to do so. In civil life all the functions here particularised are vested in the superintendent or house-

governor, subject to the final control of the board or committee of management.

14. *Supply.* The steward should furnish the hospital according to a fixed scale, previously agreed upon.

15. The mode of supply by requisitions is faulty both ways, both in pretending to supply that which is not in store, and in not supplying that which is; for the requisition remains, although the supply has never been given; and the supply is not often given, although it is in store.

16. With regard to food, let the steward make contracts, subject to the governor's approval, and with power to buy in the market at the contractor's expense, if the contractor fails.

17. A scheme of diets should be framed, according to the most approved authorities, in order to save the cumbrous machinery of extra diet-rolls.

18. Equivalents should be laid down, so as to afford the necessary choice, depending on the nature of the climate, the season of the year, the state of the market, the productions of the country, &c.

19. A registrar is an essentially necessary officer in a military general hospital. The absence of registration in the hospitals at Scutari left the accounts in general, and those of mortality in particular, of no reliance. "They convey no trustworthy idea as to the sickness and mortality of the army in the East."

20. The medical officers of our hospitals of the United Kingdom, whether physicians, surgeons, or apothecaries, are appointed by the votes of the governors, or by the nomination of council, as in the instance of the King's College and University Hospitals of London. The election to office by vote of the governors is, however, by far the more general mode.

21. *Hours of visiting.* The hours for performing the medical and surgical services of hospitals would seem to depend on and be regulated by social habits; the visits being paid in France in the early morning, and in England during the afternoon.

22. *Number of beds to each Physician and Surgeon.* M. de Watteville limits the number of patients to be placed in charge of each medical officer to forty; while in England the average appears to vary very considerably. In our large London hospitals it is much above this number. The average of four such hospitals gives sixty-two beds to each officer having charge of in-patients; which number, however, is somewhat diminished in practice by the habit of allowing beds to obstetric Physicians and Assistant-Surgeons. In the country the allowance is very much less. The average of eight country hospitals gave only twenty-five beds to each officer having charge of in-patients.*

Subdivision, distribution, and selection of the sick. The proper subdivision and selection of the sick and wounded must every where constitute a primary consideration of hospital construction and general arrangement, for there is a certain ratio between the number of sick placed in a building, and in a ward, and the amount of mortality.

2. The number of patients admitted into an hospital does not by any means indicate the number of lives preserved, the degree of misery lessened, the sum of benefit to the community. The proportion actually cured and relieved, in a given brief period, is what truly expresses the happy consequences to society.

3. The system of hospitals is too often founded in error; the true systems being founded on the principle of relieving and dismissing in a short time; and thus the sum of patients relieved in a given period may be even greater from a less than from a larger number of inhabitants.

4. The extent to which subdivision should be carried must be determined by the twofold consideration of uniting the greatest advantages as to health,

* The numbers are taken from the Appendix to the Sixth Report of the Medical Officer of the Privy Council.

with the greatest facilities as to administration, reference being had to economy.

5. Too great a subdivision of sick must necessarily incur an increase of cost in administration and nursing. On examining the experience of British and French hospitals, it is found that from a hundred to a hundred and twenty sick may safely and economically be treated under one roof, provided the ventilation and cubic space be sufficient, and the structure and communications of the building be so arranged as to facilitate the administration and nursing.

6. The wards should hold from twenty-five to thirty-two sick; each bed having from 1,500 to 2,000 cubic feet of air-space allotted to it.

7. The following table exhibits the proportions of a ward for thirty-two patients; the first column gives the proportions of such a ward in the Lariboisière Hospital; the second, the proportions adapted to a larger cubical space, such as is given in our best hospitals in this country:

Proportions of Ward.	feet. in.	feet. in.
Length of ward	111 6	128 0
Breadth	30 0	30 0
Height	17 0	17 6
Wall-spaces between end-walls and windows	5 0	6 4
Breadth of windows	4 8	4 8
Breadth of wall-space between windows	9 2	11 4
Height of windows	13 0	13 6
Cubic space per bed	1,760 0	2,100 0

8. The proportions of a ward for twenty patients might be 80 feet long by 25 feet wide and 16 feet high; this would give about 1,600 cubic feet to each bed.

9. One window at least should be allotted to every two beds, for purposes of light and air; there are hospitals with a window to each bed.

10. Much has of late been said about the benefits of small wards for from six to ten sick, about the greater comfort and privacy of such wards, and the greater facility for ventilation which they afford. It is simply an error to assume that small wards afford any such advantages. Privacy, in an hospital, does not extend beyond any two adjacent beds.

11. Each bed should have a space of eight feet on the average, with twelve feet between foot and foot; beds should be at least three feet apart; and where there are bad fever-cases, one bed should be empty, for the purpose of isolating each such patient. Impure air, whether emanating from the person or the excretions, diminishes as the square of the distance.

12. In our civil hospitals in England the amount of cubic space varies from 600 to 2,000 cubic feet per bed; in Paris, 1,700; and in London, 2,000, and even 2,500 cubic feet are now thought advisable.

13. In some military hospitals it was under 300; 700 to 800 appear to have been considered a somewhat extravagant allowance. The army regulation as to cubic space in hospitals was, up to a recent period, overcrowding.

14. In open sites and in the country a less cubic space is demanded than in towns. In detached pavilions, or in tents, especially if they be of but one story high, less cubic space is required than where numbers are massed together.

15. The very constitutions of sick and wounded persons render them more susceptible of morbid impressions than the healthy; the sick, therefore, ought always to enjoy a larger breathing-space than the healthy.

16. Cubic space above the bed is not sufficient for the sick, who should

have a sufficient surface-area also between the adjoining and the opposite beds. For the comfort and welfare of the sick each bed should have a surface-area of at least 8 feet wide by 12 feet long.

17. There will be a high rate of mortality amongst healthy men in large barracks, and a low rate in separate huts, even with a much less cubic space.

18. The largest of the Scutari hospitals, which contained at one time 2,500 sick and wounded under its roof, and where, at one time, not half even of regulation amount of cubic space was given, lost two out of five of the patients treated; while in the hospital tents of the Crimea, the sick being almost without shelter, without blankets, without proper food or medicines, the mortality was not above one-half what it was at Scutari.

19. But this was not the only danger of overcrowding; eighty cases of hospital gangrene were recorded during one month at Scutari, and very many more occurred which were not recorded; and out of forty-four secondary amputations of the lower extremities performed consecutively, thirty-six died. Fever also broke out in this miserable hospital, not by tens but by hundreds.

20. No stronger condemnation of any hospital or ward can be pronounced than the simple fact of any zymotic disease originating in it, or that such diseases have attacked other patients than those brought in with them.

21. With proper sanitary precautions, diseases reputed to be the most infectious may be treated in wards among other sick without any danger.

22. As to the proper distribution of the sick, four wards of ten patients each, taking the average of patients in London, cannot be efficiently overlooked by one head-nurse. Forty patients in one ward can be fully overlooked by one head-nurse.

23. Let us accept the principle that no hospital shall exceed two floors in height. By such an arrangement and construction the sick are spread over a wider area, the walls are not so high as to interfere with the sunlight and ventilation of the neighbouring pavilions, the accumulation of hospital miasm in the upper flats is avoided, access to the wards is easier for patients and attendants, and the whole administration is much facilitated.

24. "It will cost more money to accommodate a given number of sick in a hospital of two than in one of four flats; but the question has been discussed and decided on the Continent, notwithstanding, that the hospital of two flats is better than one of additional stories; and many hospitals of two stories have there been built.

25. "But even admitting the argument of the expensiveness of land as being entirely valid, the conclusion is certainly not that hospitals three and four flats high should be built in towns; but that hospitals should be built in the country, where land is less expensive.

26. "It is little else than a breach of trust to build great lofty architectural structures, merely to flatter the bad taste of committees or governors; or to place the hospitals in a close unhealthy neighbourhood, to suit the convenience of medical attendants, when the object of the whole ought to be the recovery of the sick.

27. "The number of sick which may be safely placed under one roof will, to a certain extent, be determined by the local position of the hospital, by the extent of cubic space allotted to the patients, and by the state of ventilation. In the most recent hospitals the numbers vary considerably.

28. "Thus, in the Royal Marine Hospital, which is at present being erected at Woolwich, 84 sick are to be accommodated under one roof. In the proposed hospital at Aldershot there will be arrangements for about 100. In each of the hospital blocks at Beaujon, in Paris, there are arrangements for 60 sick. In the magnificent hospital Lariboisière, at Paris, the number is 102 per block. In the hospital St. Jean, at Brussels, it is about 88.

29. "Too great a subdivision of sick must necessarily incur an increase of cost in administration and nursing. On examining the experience of all these

hospitals, we are of opinion that from 100 to 120 sick may be safely and economically treated under one roof, provided the ventilation and cubic space be sufficient, and the structure and communications of the building be so arranged as to facilitate the administration and nursing."

30. Where labour is misapplied, it often happens that more time and care are given to passages, stairs, &c. than to the sick. To obviate this, extreme simplicity of construction and detail is essential.

31. Small casualty wards are much better placed apart, with their staff complete and separate, rather than attached—one small ward to each larger one.

32. Much superfluous argumentation has been thrown away upon the questions of the arrangement and distribution of sick in hospitals; discussions which might have been spared, had better hospitals existed in times past. Even now, indeed, much of what is set forth in this essay applies mainly to hospitals as they are; for it may be received as a truth having few exceptions, that if ventilation, cleanliness, and the general hygiene of an institution be duly attended to, we need trouble ourselves but little as to what description of cases shall be placed in adjoining beds in our wards, provided always that noisy or troublesome patients receive their special and proper places.

33. Eruptive diseases, eruptive fevers, erysipelatous diseases, ophthalmia, have been considered as demanding separate and more or less strict seclusion, on account of the safety of others; so much so indeed, that for the treatment of some of the diseases mentioned special hospitals have been founded.

34. Robert Jackson gives preference to the upper floors of hospitals which consist of two stories for the reception of cases suffering from acute diseases, as being less exposed to noise and bustle.

35. The benefits of classing the sick according to similarity of disease he considers as obvious, as regards economy of labour, facility for prescribing, and correct appreciation of effect.

36. An active discussion has lately taken place in the professional and also in the public journals, on the advantages and disadvantages of special hospitals for the separate treatment of various diseases. The question is an important one; and it is probable that it will receive a final settlement in financial considerations, and those connected with the public and the professional convenience.

37. When we contrast the incomes and the amount of actual relief, for instance, of the fourteen metropolitan general hospitals, with the incomes and the amount of relief in the thirty-six special hospitals of London, we arrive at once at a conclusion in favour of the former institutions, on the score of financial and charitable advantages.

38. What appears to be wanted is, to bring the two classes of institutions together under one roof; the general hospitals classifying special diseases in special wards, as already done in some of our great hospitals. By such arrangement the general hospitals will increase in power and usefulness, and the special hospitals will gradually give place to the cheaper and more beneficial charity.

Admission into Hospital. The justice of the principle is unquestionable, that all indigent sick inhabitants, and all poor wayfarers who may fall sick on their travels, ought to be admitted into the nearest hospital; indeed, no hospital establishment, whether in our great cities or in the provinces, can be said to be complete until this desideratum shall be accomplished. All servants of the public, all seamen and soldiers of the State, should have free admission into the nearest civil hospital, it being understood that naval and military hospitals are too distant to be resorted to.

The selection of patients. Dr. Guy regards it as a fact that the great leading cause which determines the mortality of hospitals is the question here noticed. He says that "the attendance of a numerous class of pupils

craving for instruction leads naturally and necessarily to a selection of severe and dangerous cases, while the attachment of practitioners to their *alma mater* brings about with equal certainty a supply of cases for medical treatment and for surgical operation, among which cases an undue mortality may be expected to occur.

2. "That this is the true explanation of the higher rates of mortality to be found in the tables published by the Statistical Society of London, is rendered in the highest degree probable by the fact that the four hospitals which present the highest rates of mortality are, St. Bartholomew's and Guy's, King's College and University College. In the last of the series of published tables, the mortality of these four hospital-schools is shown to range from 110 to 115 in 1000. The other hospital-schools are found to occupy an intermediate position between the four hospitals which have the honourable distinction of a higher rate of mortality and the hospitals which have no medical schools attached, and which enjoy the unenviable privilege of displaying a rate of mortality rising from 60 to 82 in 1000.

3. "Seeing that the rate of mortality in hospitals varies so little with locality, site, size, spaciousness, and so much with the sex of patients, and the medical and surgical character of their maladies, it is obvious that more may be done to raise or lower the rate of mortality of our hospitals by selection of patients than by all other causes put together, excepting always such a degree of overcrowding and neglect of obvious sanitary precautions as are no longer possible in the hospitals of London.

4. "It must also be quite evident that if, to an unequal distribution of men and women, and a variable proportion of medical and surgical cases, we were to add the element of a selection by one hospital of the more serious class of cases, surgical and medical, and by another of cases of a less severe character, we should be able to produce at will almost any rate of mortality between the limits of 50 or 60 per 1000 and 110 or 120 per 1000.

5. "Now this sort of selection does go on almost unconsciously in the case of those hospitals which have attached to them medical schools, and in the greatest degree in those which have the largest schools, and through them the largest connexion of old students."

Such are the conclusions of Dr. Guy upon this most important question; and he promises to follow them up by a careful statistical record. We look forward with interest to the fulfilment of that promise; for the value of all opinion must end where demonstration begins.

THE DIETING OF THE SICK—HOSPITAL COOKING.

Regarding the practical common-sense views of Miss Nightingale to be of that kind of pure observation which so frequently precedes science, and which is always so profitable to undemonstrated science, I propose here to quote her rules on the subject of dieting the sick to some extent. I should desire, indeed, to quote her two articles entire, but space will not admit of such indulgence.

It is confidently stated that the diet in London generally, as compared to that of Paris, is more substantial, nourishing, and invigorating; and this advantage is said to attach to the Englishman both before and after he becomes a patient in the hospital.

2. "In laying down rules of diet by the amounts of 'solid nutriment' in different kinds of food, it is constantly lost sight of what the patient requires to repair his waste, what he can take and what he cannot.

3. "You cannot diet a patient from a book; you cannot make up the human body as you would make up a prescription—so many parts 'carboniferous,' so many parts 'nitrogenous,' will constitute a perfect diet for a patient. The nurse's observation will here materially assist the doctor; the patient's 'fancies' will materially assist the nurse.

4. "Organic chemistry is useful, as all knowledge is, when we come face

to face with nature ; but it by no means follows that we should learn in the laboratory any one of the reparative processes going on in disease.

5. "Chemistry has as yet afforded little insight into the dieting of sick. All that chemistry can tell us is the amount of 'carboniferous' or 'nitrogenous' elements discoverable in different dietetic articles. It has given us lists of dietetic substances, arranged in the order of their richness in one or other of these principles ; but that is all.

6. "In the great majority of cases, the stomach of the patient is guided by other principles of selection than merely the amount of carbon or nitrogen in the diet. No doubt, in this as in other things, nature has very definite rules for her guidance ; but these rules can only be ascertained by the most careful observation at the bed-side. She there teaches us that living chemistry, the chemistry of reparation, is something different from the chemistry of the laboratory.

7. "An almost universal error amongst nurses is the bulk of the food, and especially of the drinks they offer to their patients. Suppose a patient ordered four ounces of brandy during the day, how is he to take this if you make it into four pints by diluting it? The same with tea and beef-tea, with arrowroot, milk, &c. You have not increased the nourishment, you have not increased the renovating power of these articles by increasing their bulk ; you have very likely diminished both by giving the patient's digestion more to do ; and most likely of all, the patient will leave half of what he has been ordered to take, because he cannot swallow the bulk with which you have been pleased to invest it.

8. "It requires very nice observation and care (and meets with hardly any) to determine what will not be too thick or strong for the patient to take, while giving him no more than the bulk which he is able to swallow. . . . The diet which will keep the healthy man healthy will kill the sick one. The same beef, which is the most nutritive of all meat, and which nourishes the healthy man, is the least nourishing of all food for the sick man, whose half-dead stomach can *assimilate* no part of it, that is, make no food out of it."

9. Respecting beef-tea and other articles of diet, much error has been heedlessly accepted for truth : "One is the belief that beef-tea is the most nutritious of all articles." It is of little dependence "with the healthy and convalescent, where there is much nourishment required. . . . On a diet of beef-tea healthy men speedily lose their strength."

10. But "there is a certain reparative quality in it,—we know not what ;" and "it may safely be given in any inflammatory disease."

11. Dr. Christison observes, that "every one will be struck with the readiness with which certain classes of patients, as cases of gastric fever especially, while they refuse all other food, take readily to beef-tea or dilute meat-juice, using little or nothing else for weeks or even months ; and yet a pint of beef-tea contains scarcely $\frac{1}{4}$ oz. of any thing but water." The result, however, is so striking that he asks what is the mode of action. "Not simply nutrient, $\frac{1}{4}$ oz. of the most nutritive material cannot nearly replace the daily wear and tear of the tissues in any circumstances. Possibly," he says, "it belongs to a new denomination of remedies."

12. "It has been observed that a small quantity of beef-tea, added to other articles of nutrition, augments their power out of all proportion to the additional amount of solid matter. The reason why jelly should be innutritious, and beef-tea nutritious, to the sick, is a secret yet undiscovered ; but it clearly shows that careful observation of the sick is the only clue to the best dieting.

13. "It is an ever-ready saw that an egg is equivalent to a pound of meat ; whereas it is not at all so. Also it is seldom noticed with how many patients, particularly with nervous and bilious temperaments, eggs disagree. All puddings made with eggs are distasteful to them in consequence. An egg whipped-up with wine is often the only form in which they can take this kind of nourishment.

14. "Again, if a patient has attained to eating meat, it is supposed that to give him meat is the only thing necessary for his recovery ; whereas scorbutic sores have been actually known to appear among sick persons living in the midst of plenty in England, which could be traced to no other source than this, viz. that the nurse, depending on meat alone, had allowed the patient to be without vegetables for a considerable time, these latter being so badly cooked that he always left them untouched.

15. "Arrowroot is another grand dependence of the nurse. As a vehicle for wine, and as a restorative quickly prepared, it is all very well. But it is nothing but starch and water. Flour is both more nutritive, and less liable to ferment, and is preferable wherever it can be used.

16. "Flour, oats, groats, barley and their kind, are preferable in all their preparations to all the preparations of arrowroot, sago, tapioca, and their kind.

17. "Milk, and all the preparations from milk, are a most important article of food for the sick. Cream, in many long chronic diseases, is quite irreplaceable by any other article whatever. It seems to act in the same manner as beef-tea, and to most it is much easier of digestion than milk. In fact, it seldom disagrees.

18. "Butter is the lightest kind of animal fat ; and though it wants the sugar and some other elements which there are in milk, yet it is most valuable both in itself and in enabling the patient to eat more bread.

19. "Cheese is not usually digestible by the sick, but is pure nourishment for repairing waste ; and I have seen sick, and not a few either, whose craving for cheese showed how much it was needed by them."

20. In a note on the instinctive cravings of the sick, Miss Nightingale makes an observation, the truth of which will be vouched for by all who, like her, have seen scorbutic dysentery : "In diseases produced by bad food, such as scorbutic dysentery and diarrhoea, the patient's stomach often craves for and digests things, some of which certainly would be laid down in no dietary that ever was invented for sick, and especially not for such sick. These are fruit, pickles, jams, gingerbread, fat of ham or bacon, suet, cheese, butter, milk. These cases I have seen not by ones, nor by tens, but by hundreds. And the patient's stomach was right, and the book was wrong. The articles craved for, in these cases, might have been principally arranged under the two heads of fat and vegetable acids.

21. "There is often a marked difference between men and women in this matter of sick feeding. Women's digestion is generally slower."

22. Reverting to the article of milk, Miss Nightingale says : "But, if fresh milk is so valuable a food for the sick, the least change or sourness in it makes it perhaps of all articles the most injurious ; diarrhoea being a common result of fresh milk allowed to become at all sour. The nurse therefore ought to exercise her utmost care in this.

23. "Buttermilk, a totally different thing, is very useful, especially in fevers.

24. "The nutritive power of milk, and of the preparations from milk, is very much undervalued ; there is nearly as much nourishment in half-a-pint of milk as there is in a quarter of a pound of meat. But this is not the whole question, or nearly the whole. The main question is, what the patient's stomach can assimilate or derive nourishment from ; and of this the patient's stomach is the sole judge. Chemistry cannot tell this. The patient's stomach must be its own chemist.

25. "I have known patients live for many months without touching bread, because they could not eat baker's bread. These were mostly country patients, but not all. Home-bread or brown bread is a most important article of diet for many patients. The use of aperients may be entirely superseded by it. Oat-cake is another."

26. Miss Nightingale justly observes that sound observation has scarcely yet been brought to bear on sick diet. "To watch for the opinions which the

patient's stomach gives, rather than to read 'analyses of foods,' is the business of all those who have to settle what the patient is to eat; perhaps the most important thing to be provided for him after the air he is to breathe."

27. The circumstances which call for variations as to quality and quantity of food in hospitals, are: Nature of the disease, whether acute or chronic, sthenic or asthenic; age; sex; previous habits of life; employments; season; conformation of body.

(a) *Nature of the disease.* There is perhaps no diseased state found in hospitals for the cure of disease in which so much food should be given as in health. In acute disease, the activity of all the functions must be lessened, and therefore less food of all kinds given, especially of the nitrogenous kind, since on that quality mainly depends the activity of function. In chronic disease there is usually a reduced state of the powers of transformation, and hence starchy food should not be given in excess; while a full admixture of nitrogenous food is called for. Moreover, the heart's action is often enfeebled in such states; and then nutritive articles of diet, with ale or wine, are called for.

(b) *Age.* Under the age of twenty-two, some excess of food must be allowed to maintain growth. In old age the quantity should be less than in middle life; and then the quality should be such as to contain more nitrogenous food, or that which promotes the transformation of starch and fat. Arrowroot taken alone is then wasted, and probably the same may be said of fat.

(c) *Sex.* The difference in the amount of nutriment required by the two sexes is less than is found in the dietaries of gaols. The chief ground for the difference is, the difference in weight and size of the body.

(d) *Previous habits and employments.* These considerations must constitute a reason for variation in diet; but, from evident causes, the requirements can only be met by having two or more classes of dietaries, one of which shall suffice for those whose occupations have been more laborious, and another for such as have been of sedentary habit; more nutriment being, as matter of course, required for the former class.

(e) *Season.* The quantity of food supplied in the winter months should be one-sixth greater than in June, July, August, and September, and it should be rich both in nitrogen and carbon. In the summer months the quantity of starch and fat should be much lessened, and in a greater degree than the nitrogenous, since then the powerful indirect transforming action of cold is absent.

(f) *Conformation of body.* The chief circumstance here to be noticed is, that persons of unusual height and girth demand an unusual supply of food.

28. Dr. Edward Smith offers the following suggestions for a scheme of dieting fitted for the Liverpool Infirmary and the general hospitals of the country:

"There should be but three dietaries.

(a) "The normal one, which would be proper for ordinary cases, where the supply should as nearly as possible balance the waste.

(b) "The sick dietary, suited to acute cases, in which the supply is insufficient to balance the waste.

(c) "The convalescent dietary, in which the supply is greater than the waste. Such terms as 'low,' 'full,' &c., are inadmissible, since they influence the minds of the patients, and probably mere numerical distinctions would be best.

29. "There should not be such variation in the food supplied from day to day as would materially vary the amount of nutriment supplied; and when alterations are provided, they should be nearly equal in nutritive value; as, for example, eggs for milk, or peas for cereals. Such alteration should be exceptional, and be applied to the special case of the patient.

30. "Milk should form a large part of every hospital dietary. Thus, in B,

three-fourths of a pint at breakfast and supper; and in c, a pint at each of those meals.

31. "I doubt much if more than 4 oz. of cooked meat without bone ought to be given to men, or more than 3 oz. to women in any class; and I should recommend these quantities in B and C. I am persuaded that too much meat is given in many hospital and prison dietaries, considering the healthfulness, vigour, and duration of life of the agricultural population living almost without it; and also the evils met with in towns' populations, amongst the well fed, who yet seldom eat more than the above allowance. I have seen great evils in hospital practice from an unlimited supply of meat, even in such cases as phthisis.

SCHEME.

	A (sick).	B (normal).	C (convalescent).	NOTES.
BREAKFAST, 8½ A.M.	⅓ pint milk, 3 oz. bread (or oatmeal).	¾ pint new milk 6 oz. bread, 2 oz. oatmeal.	1 pint new milk, 8 oz. bread, 3 oz. oatmeal.	N.B. The milk should be new or old, as fat is improper, or otherwise.
		When cocoa or coffee with sugar is given, omit the oatmeal, and give ½ pint milk.		
DINNER, 1½ P.M.	⅓ pint milk, made into pud- ding, with rice, sago, &c.; or ½ pint beef-tea, 4 oz. bread.	Meat, 4 oz. men 3 oz. women Bread . 6 oz. Potato . 8 oz. Cheese . ½ oz.	———— 4 oz. ———— 3 oz. ———— 8 oz. ———— 8 oz. ———— 1 oz.	
		¾ pint of broth	with boiled meat.	In A and C the broth should contain herbs.
SUPPER, 6½ to 7; bed at 8.	All the same as breakfast, with addition of cereal.			In all salt supplied <i>ad lib.</i> Malt liquors as exceptions.

32. "The meat should be of the best quality, from good joints, be served hot, be roasted or boiled, and be varied in kind; and when boiled, the liquor should be served with it.

33. "Considering that potato is two-and-a-half times dearer than an equal amount of nutriment in bread, I would limit the supply of it to half a pound, cooked.

34. "Seeing that in a day of fasting the carbon exhaled is equal to that contained in twenty ounces of bread, the daily supply of bread to B should not be less than eighteen ounces, and to C not less than twenty-four ounces.

35. "Cheese, in small quantity, should be supplied after dinner, both because it promotes the transformation of food, and adds largely to the nitrogen. Half-an-ounce to B, and one ounce to C. When bread and cheese is preferred to bread and milk for supper, it would be easy to determine the suitable equivalent, since cheese also contains fat.

36. "I cannot think that tea is proper in B and C, except when the assimilative function is much deficient, and then the bulk of fluid should be so small as to admit of the addition of half a pint of milk. I would make it an exceptional article of dietary.

37. "Coffee might with less impropriety be given with half a pint of milk for breakfast; but it is clear that both tea and coffee tend to increase waste.

38. "The various cereals with milk are the most suitable for breakfast and supper.

39. "In my opinion, a sick dietary should differ from the foregoing only in the lesser quantity of the above-mentioned articles, and care should be taken not to rely upon such articles as tea, which increases waste, or beef-tea made hot, which can only very partially sustain the animal functions. I think a too great deficiency of nutriment is often found in the 'low diet.'

40. "In the above scheme there would be fat in the milk ($\frac{3}{4}$ oz. in 1 pint) and in the well-fed flesh ($\frac{1}{8}$), and this, with or without butter, would be ample, in addition to the starch supplied in the cereals and the potato. I have also been influenced in my opinions by my experiments published in the *Philosophical Transactions* for 1859, and in the *Dublin Quarterly Journal* for February 1860."

41. *Cooking*. "Many a patient can eat," says Miss Nightingale, "if you can only tempt his appetite. The fault lies in your not having got him the thing that he fancies.

42. "But another patient does not care between grapes and turnips,—every thing is equally distasteful to him. He would try to eat any thing which would do him good; but every thing 'makes him worse.' The fault here generally lies in the cooking.

43. "It is not his 'appetite which requires tempting,'—it is his digestion which requires sparing. A good sick cook will save the digestion half its work.

44. "There may be four causes, any one of which will produce the same result, viz. the patient slowly starving to death from want of nutrition:

1. Defect of cooking.
2. Defect in choice of diet.
3. Defect in choice of hours for taking diet.
4. Defect of appetite in the patient.

Yet all these are generally comprehended in one sweeping assertion, that the patient has 'no appetite.'

45. "Surely many lives might be saved by drawing a closer distinction; for the remedies are as diverse as the causes. The remedy for the first is to cook better; for the second, to choose other articles of diet; for the third, to watch for the hours when the patient is in want of food; for the fourth, to show him what he likes, and sometimes unexpectedly. But no one of those remedies will do for any other of the defects not corresponding with it.

46. "I cannot too often repeat, that patients are generally either too languid to observe these things, or too shy to speak about them: nor is it well that they should be made to observe them; it fixes their attention upon themselves.

47. "Again I say, what is the nurse or friend for, except to take note of these things, instead of the patient doing so?

48. "It is commonly supposed that the nurse is there to spare the patient from making physical exertion for himself; I would rather say, she ought to be there to spare him from taking thought for himself. I am quite sure that if the patient were spared all thought for himself, and *not* spared all physical exertion, he would be infinitely the gainer.

49. "The reverse is generally the case in the private house. In the hospital, it is the relief from all anxiety, afforded by the rules of a well-regulated institution, which has often such a beneficial effect upon the patient."

Nursing and nurses in military hospitals. In all European states there are more women than men above twenty years of age; and we may assume

that such is the law of nature, and that it is designed to answer beneficent ends in human society.

It should seem obvious enough that the virtues which in all ages and all countries have ruled the domestic circle; that "she who looketh well to the household, and eateth not the bread of idleness;" that she whose "tongue is the law of kindness," should have a natural and a large share in the tending of the sick and maimed. To the natural care of the sick and wounded, we must add the natural care of the infant and the aged, along with the household cares and the rearing and training of children.

Requirements of so extended and important a character, capable of such infinite development, cannot be limited to the household affairs of common life. They must be brought systematically in aid of the sick in hospital, for purposes of nursing and of general administration.

2. One of these ends, whether in private or public relation, would appear to be the care of the sick; an occupation for which woman, whether taken from the instinctive tuitions of the sanctuary of home, or from the trained service of the hospital, possesses unequalled aptitudes and capabilities. Every where and at all times the number of nurses to be employed in a hospital must be regulated by the nature of the prevailing diseases, whether epidemic, acute, or chronic.

3. So far back as 1791, we find it stated by the governors of the London Hospital, that "women are better judges than men upon many occasions; particularly in what relates to women's wards, the laundry, the kitchen, to beds, linen, &c."

4. Donald Monro, in his observations on "Movable Hospitals on Expedition Service," speaks of the "matron or head-nurse," and of the "common nurses," as ordinary matter-of-course parts of the hospital service of his time (1760-1780), and he proposes excellent regulations for their conduct.

5. In the Artillery Hospital, Woolwich, in 1801, Dr. Rollo states that a matron and nurse formed part of the permanent establishment. "There was a nurse to every three wards, being a charge of fifteen to sixteen patients, whose duty it was to attend upon the men, make their beds, supply them with drinks, keep them clean, and take the charge of preserving the furniture and utensils, and of washing and sweeping the rooms. The duty of washing and sweeping the galleries and passages is done by the nurses alternately in a period of a week at a time. They also take in rotation the duties of night-nurses, when there are patients requiring such attendance."

6. In the artillery hospitals in the West Indies, a nurse was allowed for every twelve sick. Dr. Rollo adds, that "the nurses and servants ought to be entirely under direction of the Surgeon, and to be answerable to him alone for their conduct, and for holding their appointments."

7. As regards the principle of female service, our main object should be, to improve hospitals by improving hospital-service; and to assure so essential a benefit to the sick, we must improve the class of nurses and head-nurses.

8. Miss Nightingale thinks that the woman is superior in skill to the man in all of sanitary domestic economy, and more particularly in cleanliness and tidiness. Sanitary civil reformers will always tell us that they look to the women to carry out practically their hygienic reforms. She has a superior aptitude in *nursing* the well quite as much as in nursing the sick. At the same time, Miss Nightingale is bound to say that nothing can be more perfect, at least to outward appearance, than the cleanliness of a ship. But the sailor is a race *à part*.

9. It is the peculiar skill and industry of the English labourer's wife to which all this is referable in the one case, and to the incompetency of men on the other to conduct the domestic economy of a home or a hospital. Miss Nightingale thinks the Anglo-Saxon would be very sorry to turn women out of his own house, or out of civil hospitals, hotels, institutions of all kinds, and substitute men-housekeepers and men-matrons. The contrast between

even naval hospitals, where there are female nurses, and military hospitals where there are none, is most striking in point of order and cleanliness.

10. There is a great difference in Miss Nightingale's experience, generally speaking, among the women of Great Britain and Ireland in this respect. She would put the Anglo-Saxon race in the southern and north-western counties first in point of domestic management; far below these come the Danish race in the eastern counties, and the mixed race in the manufacturing counties; and last, the Irish and Highland Celt.

11. Our authority proposes to introduce so great and necessary an improvement into our hospital management, "not by founding a religious order, as on the continent of Europe, but by training, systematising, and morally improving, as far as may be permitted, that section of the large class of women supporting themselves by labour, who take to hospital nursing for a livelihood; by inducing, in the long-run, some such women to contemplate usefulness, and the service of God in the relief of man, as well as maintenance; and by incorporating with both those classes a certain proportion of gentlewomen who may think fit to adopt this occupation without pay, but under the same rules, and on the same strict footing of duty performed under definite superiors. These two latter elements, if efficient (if not, they would be mischievous rather than useless), I consider would elevate and leaven the mass.

12. "The care of the sick is the main object of hospitals. The care of their souls is the great province of the clergy of hospitals. The care of their bodies is the duty of the nurses. Possibly this duty might be better fulfilled by religious nurses than by sisters of any order; because the careful, skilful, and frequent performance of certain coarse, servile, personal offices is of momentous consequence in many forms of severe illness and severe injury; and prudery, a thing which appears incidental, though not necessarily so, to female orders, is adverse to or incompatible with this.

13. "Grave and peculiar difficulties attend the incorporation of members of orders, especially of Roman Catholic orders, into the work. And both with reference to the Queen's hospitals, and still more to civil hospitals, I humbly submit that much thought, and some consultation with a few impartial and judicious men, should precede the experiment of their introduction. This appears to me one of the most important questions for decision. Should it be decided in favour of their introduction, I trust it may be resolved to do so only tentatively and experimentally.

14. "Their introduction is certain to effect far more harm in some ways than it can ever effect good in others." Their incorporation, especially as regards the Roman Catholic Sisters, will be a constant source of confusion, of weakness, of disunion, and of mischief.

15. Nurses cannot be advantageously introduced into our regimental hospitals; but into military general hospitals female nursing might be introduced both at home and in the field, if only women of efficiency, responsibility, and of as good character as head-nurses in civil hospitals be appointed.

16. One nurse may be allotted to not less than twenty-five bad cases; the orderlies doing, under the head female nurse, the duty done in civil hospitals by assistant nurses.

17. But the head female nurse must be in charge of all that pertains to the bedside of the patient,—of his cleanliness, that of his bed and utensils, of the administration of medicine, of food, of the minor dressings not performed by the Surgeon; in short, all that concerns the personal obedience of the patient to the orders of the Surgeon.

18. The head female nurse must accompany the Surgeon in his visits, and receive his orders. She must also be in charge of the ventilation and warming of the ward. She must report any disobedience of orderlies, as far as regards the patient's personal treatment.

19. There need be no clashing with ward-master or hospital-sergeant; on the contrary, it would be the duty of these to enforce the nurse's autho-

city. They will have enough to do besides, with returns and accounts, and with enforcing discipline as to hours, meals, clothing, &c. among the orderlies out of ward.

20. The female nurses should, of course, be under a female head, whose duties must be carefully arranged, so as to be in accordance with the code of hospital regulations.

21. By hospital discipline Miss Nightingale means the "enforcing hospital treatment; and hospital treatment consists in the administration of medicine, of diet, the application of the minor dressings, the cleanliness of the ward, that of the patient, his bedding, and his utensils; his personal obedience to the Surgeon's orders as to keeping his ward, his bed, or his position, &c. &c. To enforce in all these matters obedience to the Surgeon's orders, is to enforce hospital discipline.

22. "Another branch of discipline consists, no doubt, in the man's respectful demeanour to his officers, in the accuracy of the diet-rolls, returns, accounts, &c. &c. This is not here spoken of, because it is not strictly hospital work. In hospital work, the meaning of the words to be 'in charge' is, we presume, to receive the medical officer's orders, to see them obeyed, and to take measures so that they cannot be disobeyed without its being known and remedied."

23. Now, in military hospitals there is no one *thus* "in charge."

24. The ward-master or hospital-sergeant has duties so multifarious that three men could not perform them with any satisfaction; and the nursing work is generally sacrificed to the writing work, unless the ward-master be, as sometimes, though rarely, happens, a very good nurse.

25. "The orderlies do not bring 'skilled labour' to the work, and the medical-staff corps bring far less. There is no training; it is a truism, that less work is done less well in the same time by unskilled than by skilled labour.

26. "The cleaning and airing of the wards in the morning would make a housemaid laugh; at Scutari each orderly worked at it in his own way, and then the patients undid it all, and it had all to be done over again.

27. "Except when medicines were given by the medical officers themselves, or by the women, they were taken by the patient or not at his own discretion.

28. "The meals were at first irregular, and throughout the patients scrambled for them. It occurred frequently that the bad cases, when unable to feed themselves, were not fed at all, except by the women; that a great mess of cold arrowroot and wine stood by the bedside the whole day, till it was thrown away; that the poultices were put on cold, or left on till they were hard, and then not washed off; that the bed-sores were unattended to till they had become so bad that the medical officer's attention was called to them; that the patients were left dirty, unless they asked to be washed; that utensils were never emptied more than once a-day; that the keeping certain very bad cases constantly dry and clean was almost wholly unattended to; that the patients ordered to remain in bed were as often out of bed, or even out of the ward, or smoking in the privies, when these were cleansed and ventilated. The position of surgical cases in bed was generally not attended to.

29. "Many orderly medical officers were so zealous in their duties that they would drudge through all these details, and see them carried out themselves; but this is not discipline, nor can it be, unless the medical officer were in his ward through the whole twenty-four hours.

30. "The medical-staff corps are, for the most part, nothing but sweeps and ration-carriers. There are some first-rate subjects among them; but the endowments of most of them were first-rate ignorance of the very details of nursing.

31. "If all the nurses were turned out of civil hospitals, and men engaged promiscuously, without character, to do the work, we should see the same results.

32. "The medical inspectors, as far as I saw them, with some very brilliant exceptions, regarded only hospital order and mere conduct, with little reference to the state of the patients. One patient suffering from frost-bite, who subsequently died, had not been moved for a week. Being unable to leave his bed, and having been neglected, he was found in a state indescribably horrible."

33. Every ward, or set of wards, should be under a head-nurse. Discipline is always defective under other arrangement, whether in a military or a civil hospital.

34. Of acute cases, one nurse may well take charge of forty patients; while of convalescents or persons under chronic ailments, a hundred would be sufficiently served by one nurse.

35. A single attendant can easily perform the duty of night-watching for many bad cases if the beds are so placed as to be seen from a single point. The head-nurse's room should have a window looking into her ward.

36. It is highly important that patients, who must necessarily be in various stages of sickness or convalescence, should feel that they are continually under the eye of the head-nurse.

37. It is, of course, most economical to have one ward for each head-nurse. The ward, therefore, should be large enough to occupy her whole attention; but not so large as to render its ventilation difficult.

38. Small wards cannot be overlooked with sufficient strictness, unless indeed a head-nurse is to be set apart for each—an arrangement which would enormously increase the expenses of nursing, without benefiting the patients.

Nurses in civil hospitals. "The isolation of each head-nurse and her nurses appears to me very important. The head-nurse should be within reach and view of her ward both day and night. Associating nurses in large dormitories tends to corrupt the good, and make the bad worse. The ward should have but one entrance; and the head-nurse's room should be close to it, so that neither nurse nor patient can leave, nor any one enter the ward without her knowledge."

2. The day-nurses should have eight hours' sleep, and if it be possible, four hours daily for exercise, private occupation, or recreation. They may have one room.

3. The night-nurses should be on duty twelve hours, with instant dismissal if found asleep; eight hours should be allowed for sleep, and four hours for daily exercise, private occupation, or recreation. If they have no time to themselves for their mending, making, &c., they do it at night, sometimes innocently, sometimes to the injury of the patients.

4. "I would not, however, prohibit occupation at night; and doing something is far better and more awakening than doing nothing. This is one of the matters the head-nurse should constantly look to. I do not fancy, but at present am not positive about, cleansing or scrubbing at night. The night-nurse should have a reversible lamp, or something that, without disturbing the patient, gives her light, brighter than the dim fire or gas-light properly maintained in the wards at night. She should have a room to herself.

5. "At present I incline to something of the following scale. Two wards, single are best, but it might be one double ward, with forty beds, served by one head-nurse and three nurses.

6. "The head-nurse to superintend all things, and to do the dressings not done by the surgeons and dressers, assisted mainly by one nurse, whom she thus instructs in nursing.

7. "Another nurse to do the scrubbing and mainly the cleaning; and when these are over, to mind the ward during the remaining hours in turn, or in conjunction with the first nurse.

8. "The third to be the night-nurse. In the morning, before dressing begins, and before the night-nurse goes off duty, all three nurses to clean the ward, make the beds, wash the helpless patients, &c.

9. "Hours of administration of medicine to be fixed, and the medicine, always except at night, to be given by the head-nurse.

10. "Hours of morning and evening poulticing and dressing to be fixed.

11. "Hours of exercise of head-nurse and nurses to be fixed and arranged with reference to duties. A fixed occasional holiday given in turn to the nurses is good; and an annual longer holiday for them and for the head-nurses is good; a fortnight being a good limit.

12. "The holidays should be distributed in rotation during a fixed time of year, and comprehended in two or three months, or four at the outside; and no woman declining her holiday at the proper time should be allowed it at any other.

13. "The holidays cause inconvenience no doubt, but do, on the whole, far more good than harm.

14. "No head-nurse or nurse should be out of the hospital before or after the limit of her daily exercise-time, two hours, without written permission of the matron. The matron should put the cause and amount of the extension in writing, and report the same to the treasurer or chief officer at the next general meeting of the officers of the hospital. She will find this a great protection against petitions; and there is no doubt that the fewer extraordinary absences the better.

15. "Were it possible to have a small garden, in this, at strictly separated hours, the men-patients, the women-patients, the head-nurses and nurses, the men-servants if they chose, which is perhaps not likely, could walk or sit down. In college, much effect and much refreshment is produced by a green sward, a few trees, some shrubs, a fountain, and some seats.

16. "This arrangement would little interfere with its enjoyment by the dignitaries and their children, who require it quite as much, and it would be found in its results practically, and not poetically, useful.

17. "Hospitals are, and perhaps must be, in or near crowded thoroughfares. Streets are miserable places to walk in during great part of the year. Nurses want and unconsciously crave for fresh air, and often half an hour is better than more given them close to their work; and away from the streets it would be a great preservation.

18. "I should, however, be very cautious as to introducing music or any thing of that sort. Hospitals are not tea-gardens, nor homes, nor meant to be either. Great quiet, and some severity of discipline, are necessary, and ought to be exacted.

19. "I think the head-nurses should wear a regulation dress, and the nurses another: if we adopt the honest word 'livery,' in use in the hospitals, it will perhaps do no harm. Caps, dresses, and aprons should be prescribed; whether or not out-of-door dress should be prescribed, is to be considered apart.

20. "Head-nurses and nurses might wear the same dress, and some difference in the cap would be quite distinction enough. Each should have three dresses, and better, I think, avoid washing-stuffs. They require endless change to look decent.

21. "All nurses should rank and be paid alike, with progressive increase of wages after each ten years' good service, or a slow annual rise, which is better.

22. "Nurses should be of unblemished character; of strong active habits; of not less than thirty, nor of more than sixty years of age.

23. "I incline towards giving the head-nurses 50*l.* a-year, one or two rooms (one room with an alcove and curtain would be best), fuel, and light. As to the nurses' lodging: the night-nurse should have a room to herself, the others may lodge together; entire board, fuel, light, and good wages to be given.

24. "The nurses' room should be supplied with plain comfortable furniture. In large hospitals, the head-nurse furnishes her own room or rooms, which doubtless promotes her comfort and her care of the furniture—both desirable things; yet the tendency of many to accumulate decorations, which take time to clean, &c., is a drawback.

25. "I should be inclined, as an experiment, to try the furnishing plan, or at least to have some scale as to furniture allowed. A bed, arm-chair, and sofa; a chest of drawers, wash-hand table or shelf; bookcase or shelves; a little table and a large one, a couple of chairs, a footstool, and a cupboard with broad shelves, are the utmost that can be required.

26. "All provisions, &c. &c. should be as much as possible brought into the wards, or to the ward-doors, by lifts. Nothing should be fetched by the nurses. This would save much time, would enable the nurses to do more work, and yet have more leisure; and above all, would obviate the great demoralisation consequent on the nurses, patients, and men-servants congregating in numbers several times daily.

27. "The patients should be made as useful as possible, consistently with their capacities, inside the ward; but should be permitted to fetch nothing into it.

28. "A difficult and important point to settle is the amount of liberty allowed as to receiving visits. It is desirable on all accounts to make head-nurses and nurses feel comfortable, and, as it were, at home; it is also better they should not be unnecessarily out; also London distances are great, and even omnibus-fare is a consideration; also it is important to remember that these women are apt to feel and say, 'We are not in a nunnery,' nor should they be.

29. "Such are the nuisance of ordinary visitors, and the greater nuisance of extraordinary visitors, that I think, if it were possible to make the rule that no visitors are allowed, it would be a great gain.

30. "But at all events, nurses and head-nurses should only be permitted to receive visitors on certain days and hours of the week; and those hours and days should be strictly kept to. In military hospitals a still more rigid rule will be necessary.

31. "No discharged patients, however well conducted previously, should be allowed to visit the wards.

32. "Have no occasional wards, or wards for accidental and peculiar patients."

33. To the question of the Royal Commissioners, appointed to inquire into the regulations affecting the sanitary condition of the army—"Are there not matrons in all the best civil hospitals?" Miss Nightingale replied, "In all that I am acquainted with."

RESPECTIVE DUTIES AND RELATIVE POSITION OF NURSES AND ORDERLIES.

1. "The administration of diets and of medicine, the making of poultices, the application of leeches, blisters, and minor dressings, the management of the ventilation and warming of wards, should always be in the charge of the head-nurse.

2. "Under her, the cleanliness of the ward, bed, bedding, and utensils of the patients, as well as their personal cleanliness, the fetching of diets, the warming and ventilation of the wards, are to be attended to by the orderlies, but always under the nurse's surveillance; and she is to have the power of reporting disobedience on their part.

3. "The best class of men to be recruited for the medical staff corps is discharged soldiers, or civilians of good character; they should always be men who can read and write.

4. "If they are to nurse, they should be instructed in the duties of nursing, as also in those of cleaning, &c., by head female nurses, who understand these things. To the superior ranks, a few simple anatomical lectures might be given by the medical officers.

5. "Dispensers must, of course, be suitably educated, if they are to dispense.

6. "The proportion of orderlies should not be less than one to every seven sick, where there is no head female nurse. I am not speaking of convalescents.

7. "Where there is a female head-nurse, but no lifts, or supply of hot and cold water all over the buildings, still one orderly to every seven patients will not be too much. On an average, these two appliances make the difference of one orderly's duty to a ward of thirty sick.

8. "Again, a ward of thirty sick, with these appliances, will be better served by three orderlies and half a nurse (for one head-nurse could see after two such wards), than a ward without the appliances could be by four orderlies.

9. "The proportion of severe cases in military hospitals being generally much smaller than in civil ones, one nurse could overlook two wards of thirty beds, provided they were on the same floor; but in all other respects the wards should be quite separate.

10. "No man should be kept on duty in a ward more than twelve hours altogether. Watches of four hours are good, as in the naval service. But this is a question which the proper military authorities alone can decide.

11. "Twelve hours for the orderly to be off duty are not at all too much.

12. "On an average, all men and women, after a day of labour, require a good night's rest; in the long-run, and when they do not have it, either health, efficiency, or sobriety, or all three, go.

13. "A strong man is no exception to the rule; for if made to do night-duty after a laborious day, he will either go to sleep, or drink to keep awake, or he will become knocked-up before his time. It is therefore sound economy to give watchers sufficient sleep.

14. "You will get more work, and get it longer, out of the man by giving him twelve hours on duty and twelve hours off. It is better for him to have eight than seven hours' sleep; and one or two hours for exercise and fresh air each afternoon, or each alternate afternoon, make a man last longer than going to exercise himself in some tap.

15. "Supposing regular night-duty required in a ward of thirty men, supplied as above, and served by half a nurse and three orderlies, it might work thus: the principal medical officer will decide whether the same orderly should do the night-duty for a week, or the three on successive nights; probably the latter.

16. "The orderly might come on night-duty at nine P.M., and remain till nine A.M., thus taking his share in the heavy morning work of cleaning the ward, &c. A large ward got into thorough order by nine A.M. is in very good time.

17. "A nurse, whether male or female, watching and fasting in a ward from nine to nine, or even from nine to six, would either soon be unfit for duty, or put drams in his or her pocket, or doze through the night. I think, therefore, that a night-ration for night-watchers is indispensable.

18. "It should be arranged that the nurses who sleep before and after the watch may be enabled to do so quietly. This is by no means always attended to, either in civil or military hospitals."

19. After describing the uncertain arrangements for nursing in our military hospitals, Miss Nightingale concludes: "All this refers to things at home, not to war-time, nor to any emergency. Upon each and all of these systems, or no systems, it is hardly necessary to make any comments.

20. "There should be a ward-master for every five or six wards, whose whole business should be to see to the regulations and discipline of the orderlies, and to the enforcing obedience to the orders of the nurse.

21. "It is obvious that if the nurse is not in authority in regard to all that concerns the patient, her duties will become impossible; but if she is in authority, the orderlies will willingly obey her.

22. "It should therefore be compulsory that she should report a refractory orderly to the ward-master, or to the captain of orderlies, if such an officer be created.

23. "The ward-master should be in charge of all returns, accounts, states, diet-rolls, &c., so as to set the nurse completely at liberty to attend to her ward."

STATISTICS OF HOSPITALS.

"The sickness to which mankind is liable," says Dr. William Farr, "does not occur at any one time or age, but in an interspersed manner over the lifetime of each person. The constant quantity of sickness is kept up by a succession of diseases attacking the body at intervals and in paroxysms, which, however irregular they appear in a limited sphere of observation, are really definite in number, and separated by definite spaces.

2. "As a certain order is preserved in the performances of the healthy functions, so their derangement, in similar circumstances, also observes an order and regularity of succession.

3. "To accuse the human frame of perpetual malady is as ridiculous as to attribute, with some theological writers, unintermitting wickedness to the human heart; but if every alteration of the multiplied parts of the human body, every transient trouble of its infinite movements, every indigestion in man, and every fit of hysteria in woman, were reckoned, few days of human life would remain clear; and if the same scrutiny were extended to the state of the brain, the world may very civilly be sent to Anticyra—*naviget Anticyram*.

4. "In determining the quantity of sickness, and the attacks of disease, the slighter affections are therefore passed over; as, whatever difference there may be in the representation and expression, it is probable they have a tolerably constant relation, in the same class of society, to the severer cases recognised, and directly diminishing production by putting a stop to labour.

5. "Men placed in the same circumstances appear equally liable to an attack of sickness between 11 and 60 years of age; one hundred of the London labourers, in each of the decennial periods, 20-30, 30-40, 40-50, 50-60, had nearly 23·5 attacks of sickness annually; the highest number was 26·4, the lowest 22·4. A closer agreement could not, considering the extent of observation, and all the accessory circumstances, be expected.

6. "*The sick time increases with age in a geometrical progression.* If, therefore, the number of attacks at each age be the same, the duration of each attack will increase in the same ratio; and conversely, if the duration of the cases and sick time augment at the same rate, the number of attacks at every age will be equal. Any two of the elements being given, the third may always be deduced from them.

7. "Again, if the mortality of the attacked increase at the same rate as the mortality of the entire population, the proportion attacked at every age will be the same. Among the London labourers the mortality between 30-40, 40-50, was 1·48, 2·43, in one hundred living; the mortality among 100 attacked was 6·5, 10·4. Now 1·48 is to 2·43 very nearly as 6·5 is to 10·4; and it results from this, that the attacks, whatever their absolute number may be, whether 22 or 52, were the same in both periods.

8. "We pass over several important applications of these facts to practical medicine, and to practical statistics, where as in trigonometry, two of the elements of calculation can frequently be measured when the third is only attainable indirectly; expressing a hope, however, that they may be made available in the next census to throw much light upon the sanitary state of different classes of the population.

9. "External circumstances have the greatest influence on the attacks of diseases; age and the internal state of the body determine their mortality and duration. When the people of this country are placed in destructive agencies, these, like balls in battle, carry them off, by attacking a greater number; they also add to the fatality of the attack; but after a man is seized, age and vital tenacity, exclusively of medicine, are the great modifiers on which his life and sufferings depend.

10. "In epidemics the attacks generally become much more fatal at the same time that they are more numerous.

11. "When slighter and ephemeral cases are corrected, and organic dis-

eases are excluded, the duration of cases among the adults does not, according to the returns of the dock-yards, exceed twelve days."

12. Two reports of a Committee of the Council of the Statistical Society of London on hospital statistics have been published in the 5th and 7th vols. of the Journal of this Society. The information contained in the two reports is elementary and suggestive, rather than conclusive; and of this circumstance the reporters themselves would seem to be aware; for they state that "the tables which are here brought together must be regarded rather in the light of materials placed in a convenient relation to each other for the purposes of comparison, than as leading to any broad inference; or as being in themselves sufficient for the establishment of any important truths." Such materials, however, the Committee reports, "often derive an unexpected value from some inquiry which does not spring directly out of them." The difficulties and uncertainties here hinted at arise altogether from the want of simplicity and of method in the hospital records. Such being the case, we must have recourse to ascertained principles, and to such facts as may be within reach.

13. Any attempt to extend the present investigation farther back would be but a waste of time, reliable statistics being, even up to our day, hardly attained anywhere in hospital polity. Scarcely anything is known of the death-rate in hospitals during the first half and more of the last century, when, in fact, the hospitals generally throughout Europe were little better than lazarus-houses.

14. Dr. Farr, speaking of the public institutions of London, says, that in the quarter ending 31st March 1850, which may be taken as a fair average, 40,783 inmates were contained in them; "namely, on an average of the two periods given in the table, 3579 in the military and naval asylums, 670 in military and naval hospitals, 23,972 in workhouses, 3067 in hospitals for the treatment of common diseases, 3849 in lunatic asylums, and 5435 in prisons. Of 10,000 inhabitants, 108 are in workhouses, 24 in prisons, 17 in lunatic asylums, 14 in hospitals; 183 in one kind of public institution or other. In other words, 1 in 93 of the inhabitants are in workhouses, 1 in 726 in hospitals, 1 in 578 in lunatic asylums, 1 in 410 in prison."

15. This is but a general view; yet even "the most general view of the public and charitable institutions of one of the greatest cities in the world, cannot fail to be as useful as it is interesting."

16. "The fourteen general hospitals of the metropolis," says the Society's Report, "admitted into their wards in the course of a year 33,453 in-patients, and treated as out-patients and casual sufferers 313,061 more, making a total of 346,514 patients in a year.

17. "The thirty-six special hospitals and asylums received in the year 12,355 in-patients, and treated 56,068 out-patients, and, including 19,636 patients not distinctly specified as in or out-patients, a total of 88,059.

18. "The general and special hospitals taken together received 45,808 in-patients, and treated 369,129 out-patients, making a grand total of persons relieved of 434,573, including the 19,636 not classed.

19. "Forty-two general dispensaries give a return of 211,016 out-patients treated in a year.

20. "The eighteen special dispensaries return 21,862 as the number of patients attended in a year.

21. "The general and special dispensaries taken together accordingly give a return of no less than 232,878 patients treated either at their own homes, or at the institutions themselves, in the course of the year."

22. "In Paris," says Miss Nightingale, "an Annual Report of Hospitals is published; but the only useful statistical information to be gleaned from it is the number of sous each patient has cost. For, although it gives the number of adults, male and female, and of children who have been admitted and who have died during the year, yet this in itself tells little.

23. "If the hospitals of London and Paris would give us the information

contained under the eight following heads, so important would be the knowledge thereby conveyed, that it would be worth while to go back for many years to construct such tables, and to continue the same forms hereafter :

1. "The numbers admitted for each decennial period of age for each sex per annum.

2. "The numbers, similarly arranged, remaining in hospital at the end of the preceding year.

3. "The numbers dead for each sex at each decennial period of age per annum.

4. "The numbers discharged cured, similarly arranged, per annum.

5. "The numbers discharged incurable, similarly arranged, per annum.

6. "The numbers remaining in hospital at the end of the current year, similarly arranged.

7. "The *diseases* remaining, admitted, died, cured, discharged incurable, and remained, for each sex and each decennial period of age, per annum.

8. "Duration of cases similarly arranged."

9. "An ill-constructed hospital will certainly produce a high rate of mortality; but it would be an error to conclude that the death-rate is in every case an accurate test, since a high rate of death will sometimes proceed from causes independent of structural defects. In a town where people are much employed in machineries and foundries, its hospitals will necessarily receive a larger proportion of severe injuries than those of another town where the labouring classes are differently employed."

10. "It is of great importance," says Dr. Farr, "for medical men to know the average number of deaths in all cases that come under their care, in order to judge of the remedial influence of medical applications. The hospitals furnish some, although inadequate, information on this head. The sanability of the sick decreases in large cities.

11. "The rate of mortality varies in the progress of cases to their termination. It has been found that the ratio varies according to a mathematical law; describing a regular curve, which can be calculated; the results observed, and calculated, agreeing with great exactness. The law has been investigated in cholera and small-pox.

12. "Mr. Edwards first showed, from tables published by Dr. Southwood Smith, that the mortality of the fever patients in the London Fever Hospital, between 15-60, increased every year, at a rate measured by a constant (1.03) discovered by him, and applied to the construction of tables of mortality. He also first announced that if the mortality of all the patients increased in the same ratio, the number at each age between 15 and 60 must be the same; and, moreover, that as the amount of sick time increases as the mortality, the duration of each case will increase in the same ratio.

13. "After much suffering and much struggling, in the last stages of illness, in weakness and in poverty, great numbers are carried to the London hospitals and to workhouses. The division of the deaths by the population of such institutions for the reception of the sick naturally exhibits a high ratio; and the resulting mortality is very different from that which the whole population exhibits. Thus there are districts in England in which the annual mortality does not exceed 17 in 1000; in all England the annual rate of mortality was 22 in 1000; in London, in 1838-44, the annual rate of mortality was 25 in 1000; in the first quarter of 1850, it was at the rate of 24 in 1000 annually; in the same quarter, the mortality in the public institutions was at such a rate that if it continued uniform for a year, 230 would die to a 1000 inmates. The mortality was 23 per cent."

14. Referring exclusively to the general hospitals of the metropolis, "the annual rate of mortality was 82 per cent; in the consumption hospital 82 per cent; in the fever and small-pox hospitals about 302 and 304 per cent; in the lying-in hospitals the mortality of the women and children has not, this quarter, been distinguished. No inference should be drawn from the return in respect to the mortality of particular hospitals; thus, as at King's College

Hospital the mortality may be high from patients having been received in a dying state, or from an accidental concurrence of circumstances; or the mortality may be low from the removal of patients in the last stage of illness. It is well known that the mortality is not so high among surgical as it is among medical cases. The mortality in the military was lower than in the civil hospitals.

15. "The annual rate of mortality in lunatic asylums was 13 per cent. The rate in Bethlehem was 7 per cent; in other asylums the mortality varied from 13 to 22 per cent."

16. We have recently had much discussion on the mortality of the London hospitals relatively to each other, with comparisons also between these last and the death-rates of the hospitals of Paris; in which, owing chiefly, it is said, to differences of race, constitutional strength, and to the comparatively low diet of the French people generally, sick as well as healthy, the losses are uniformly higher than amongst public patients treated within the United Kingdom. It is found, however, that a comparison of mortality of one general hospital with that of another, within any given city, is surrounded by so many sources of fallacy that no reliable conclusions can be obtained. It is different in the instances of lying-in hospitals, whose death-rates afford certain materials for comparison.

17. "We possess," says the *Lancet*, "something like a standard by which to judge the normal and unavoidable risk of a woman in childbed. If that standard be much exceeded, the inference that the patients are subjected to some unusual cause of disease is perfectly logical."

MORTALITY OF HOSPITALS.

What hospital mortality may become through hospital mismanagement, we may learn from many records, civil and military; but chiefly from the records of the British army. In the Crimea alone the mortality was only short of the total loss of the original force, composed principally of old soldiers. Younger men were sent to replace them, but they died in still greater numbers, until measures of sanitary precaution were applied to the camp, the transport, and the hospital. Under neglects of every kind 18,000 men perished, but who might easily have been saved. Under the system of neglect two men died at Scutari out of every five, and one died at Koulali out of every two admitted into hospital. Under proper sanitary regulations the mortality sunk to a nineteenth part of these proportions.

2. So sensible was Dr. William Ferguson of the dangers of ill-arranged hospitals, that he declared they would destroy an army faster than any government could recruit it.

3. "In the infancy of knowledge, when Christian benevolence provided for the sick and destitute, and when it was also the sole foundation of the work, hospitals were built in situations and on plans which were far from realising the intentions of their founders. Mere shelter, food, and attendance were to be afforded to as large a number of sufferers as possible. In times of pestilence, the buildings would be crowded to excess, as we have seen in the case of the Irish workhouses during the famine of 1847. And who can tell how much of the dire loss of human life in the Middle Ages, and during the great Irish calamity alluded to, was due to benevolence misdirected?"

4. "One of the most striking illustrations of the results of absence of knowledge on those subjects is afforded by the experience of the Hôtel-Dieu, at Paris. By the statutes of its founders 'all applicants' were to be 'admitted.' It had 1200 beds, and towards the end of the last century these beds used to receive, at the same time, from 2000 to 5000 sick; and during epidemics as many as 7000 have been in the building at one time. From 20,000 to 30,000 sick passed through the hospital in one year, about 25 per cent of whom were carried to the cemeteries. In the other hospitals of Paris the mortality was about $12\frac{1}{2}$ per cent of the sick.

5. "The excuse," says Miss Nightingale, "for the enormous mortality of

the Hôtel-Dieu was the same as is put forward by ill, and even by many well-intentioned persons at the present day for the high rate of mortality in civil hospitals, and, during war, in military hospitals: viz. that only the worst cases were sent there, and that they were sent only to die. The frightful overcrowding and bad ventilation, with the absence of every sanitary precaution, were, however, the real causes of the catastrophe in the Hôtel-Dieu, just as the frightful overcrowding, and want of ventilation, the defective drainage, and want of cleanliness, were the causes of the catastrophe at Scutari."

6. Much discussion, followed by careful investigations, resulted upon both calamities; and, in the instance of the Hôtel-Dieu, eventuated in the introduction into France of vast improvements in hospital construction and management. It will be well if the experiences of our own hospitals shall lead to similar results; and, as to the example of Scutari—and we have had many such—it is to be hoped that its history may also lead to some real and permanent improvements in our military system, as well as in our military hospitals.

7. The truth is that, up to this hour, governments, hospital trustees, and committees, are too apt to conclude that they have done all that is requisite when they have provided "the very best professional advice and assistance that can be obtained;" and so, the enormous mortality of hospitals has come to be considered as unavoidable, merely indicating the per-centage of mortality inevitably resulting from disease.

8. "But nature is never to blame. If the cases be bad as possible, all the more necessity is there for care in placing them where they may have a moderate chance to recover. To place patients in musty wards, is simply to kill them, with the addition of torture. The great army-surgeon, Sir John Pringle, knew this quite well when he asserted that hospitals were amongst the chief causes of the mortality of armies. We may safely extend this remark, and say that badly constructed civil hospitals, and other charitable institutions, increase the mortality of towns and districts. We may take for granted, that no hospital ought to yield a mortality on its sick treated of seven to ten or eleven per cent, as is the case with so many of our existing metropolitan hospitals. A certain per-centage of death is inevitable, but not a per-centage such as this."

9. Within these few years the comparative mortality of the hospitals in London with each other, and with those of Paris, has been instituted in our medical periodicals; but the difficulties, as shown by Dr. Guy, are such as to render all such comparisons at present useless, or nearly so.

10. From all the calculations that could be made, Dr. Guy states that "the inhabitants of Paris are more prone to fatal diseases, or that they are exposed to more fatal local influences, or that the two unfavourable conditions are in their case united.

11. "We may safely assume that the inhabitant of Paris is a worse subject for hospital treatment than the inhabitant of London; and if the hospitals of the two capitals could be on a par in respect of all means of successful treatment, their patients would not enter them on equal terms.

12. "This, then, is one difference between the inhabitants of London and Paris. Another, and a more important difference, and one which must have a very powerful effect on the hospital mortality of the two capitals, consists in the widely different provision made for the care and treatment of the indigent, the insane, the sick, and the infirm in London and Paris respectively.

13. "Though the destitute part of the London population is provided for in sickness in the wards of our unions and workhouses, a certain small portion of that very poor population gains admission into our London hospitals. It results that probably one in fifteen of the inmates of London hospitals belong to that destitute class for which our workhouses are intended; the remaining fourteen consist chiefly of poor persons to whom the term 'destitute' could not be properly applied, and of respectable working men and artisans, with a small number of tradesmen, and a few of better station.

14. "But the task of providing for the sick poor in the more severe class of maladies is performed by our hospitals in part only; a very considerable number of the worst cases of illness being treated at the homes of the sufferers themselves, by the physicians and surgeons of our dispensaries.

15. "Nor ought it to be forgotten by any inquirer into the mortality of our London hospitals, that the hospitals themselves consist of at least three distinct classes. We have our general hospitals, our class hospitals, and our special hospitals—hospitals, endowed and unendowed, for the treatment of diseases of the more severe class, with few exceptions, and without distinction of sex or age; hospitals for women, for children, for seamen, for foreigners; hospitals for insanity, consumption, cancer, deformities, skin-diseases, and venereal maladies.

16. "Hence it happens that the wards of a general or mixed hospital present by no means a faithful picture of the more severe accidents and diseases of the population in the proportions in which they occur. Most cases of small-pox are taken to the small-pox hospital; many cases of fever are removed to the fever hospital; the insane find a hospital and a home at St. Luke's or Bethlehem; for consumptive cases there are two special hospitals; several special maladies, such as cancer, fistula, diseases of the eye, diseases of the skin, deformities, and venereal diseases, have special hospitals provided for them; and whole classes of the population, such as women, children, seamen, and foreigners, have also their own special hospitals.

17. "A minute comparison of the mortality of the London and Paris hospitals is neither necessary nor possible. The first and most fatal obstacle to such a comparison is offered by the fact that the Parisian hospitals are the recipients alike of the destitute and of the poor; so that they discharge the twofold function of the London workhouse infirmary and the London hospital.

18. "A second peculiarity, which is not without effect on the rate of mortality in the two hospitals, is, that the Parisian are supplied by the central administration with cases for which they are compelled to provide accommodation, so that they are subject to be greatly overcrowded in unhealthy years and seasons; while in London the governing bodies of our hospitals are under no such compulsion, and receive a number of patients determined, not by the wants of the population, but by their own resources.

19. "If to the two leading causes affecting the rate of mortality of the Parisian hospitals are added the two facts, that the hospitals which are best entitled to be considered as 'general hospitals' receive from the central administration those cases in excess which their physicians and surgeons may be most desirous of studying, and that the special hospitals in the two capitals do not admit of being compared with each other, the uselessness of comparing hospital with hospital in the two capitals respectively, or even comparing the aggregate of the two hospitals of the one with those of the other, must be quite obvious.

20. "The remarks which apply to a comparison between the hospitals of London and those of Paris must also apply to a like comparison between the hospitals of London and those of other considerable European cities. Each city will have its own special arrangements for the treatment of the sick poor; its own special rules for the admission of patients to the benefits of its medical charities.

21. "Nor is the case greatly altered, except in degree, when we come to compare the hospitals of London with those of our English provinces. Each metropolitan hospital has its own local and its remote sources of supply. It has its accidents and its acute cases from the immediate neighbourhood, and it draws from the environs of London itself, and from more remote rural districts its surgical cases for operation, as well as some of its worst chronic cases for medical treatment. The larger provincial hospitals have perhaps similar sources of supply, and medical and surgical cases of like severity."

22. The chief considerations, "and they enable us to arrive at results, highly probable, if not absolutely certain, of the highest interest to all who

sincerely desire to understand the true causes of hospital mortality" will, according to Dr. Guy, be found under the following heads :

- (a) Locality.
- (b) Site, and structural arrangements
- (c) Space, light, and ventilation.
- (d) Size of hospital.
- (e) Medical and surgical cases.
- (f) Males and females.
- (g) Selection of patients.

Dr. Guy "hopes to have an early and more suitable opportunity of establishing by a more considerable array of figures the important fact that the great leading cause which determines the mortality of hospitals is the *selection of patients*,—a cause which, at the point of sanitary excellence our London hospitals have now attained, appears to him to be the real determining cause of a high or a low death-rate."

To demonstrate to the satisfaction of the profession that any one cause (structural arrangement, bad or good, or the selection of patients, namely) will prove the great leading cause, or the real determining cause, of a high or a low mortality in hospitals, is what I fear we may not hope to see speedily effected; but the difficulty ought not to deter us from the prosecution of so important a course of investigation.

Dr. Bristowe and Mr. Holmes, the authors of the Report on the Hospitals of the United Kingdom comprised in the Appendix to the Sixth Annual Report of the Medical Officer of the Privy Council, have given it as their opinion, derived from personal inspection of nearly all the hospitals in the British islands and in Paris, that the causes of the great difference in death-rates in rural and urban hospitals are to be found chiefly, if not entirely, in the different kinds of cases admitted. A comparison of the admission-books of the hospitals, and of the patients actually in the wards at the time of their visit, has left no doubt on their minds that in country hospitals and infirmaries the medical cases (which at our large metropolitan hospitals are always far more fatal in proportion than the surgical) are, for the most part, trivial or chronic, and furnish comparatively few deaths in hospital. This circumstance, according to them, gives a fallacious appearance of healthiness to institutions which really are less fit places for the treatment of disease than the large hospitals of great cities: but that appearance of healthiness is obtained by neglecting or refusing to provide for the relief of the necessities of the public by the admission of fevers and urgent cases. No public hospital, according to these inquirers, is faithfully discharging its duty, which refuses to undertake the care of those persons who are most in want of it—those afflicted with the gravest form of disease—*i. e.* the infectious or epidemic maladies. The chief reform, therefore, which they suggest is the abolishment of the rules whereby the benefits of hospitals are restricted, in a great measure, to the acquaintances and dependents of the subscribers, and the more free admission of fevers and acute medical cases. This reform, however, as they intimate, will be accompanied not by a diminution of the death-rate, but, on the contrary, by its considerable increase. They regard the presence of a low death-rate in any general hospital as a proof, or at any rate a very strong presumption, that such a hospital is failing in its public duty, by restricting its charity to those of the sick who are little in need of it. While agreeing in the main with those sanitary reformers who urge the importance of pure air, cleanliness, and free ventilation, these reporters adduce evidence to show that the number of cases of disease generated in hospital is not large, if estimated by the number of deaths so occasioned, which at all our large metropolitan hospitals form a very insignificant proportion of the total deaths. If this is so, it is idle to expect that any structural improvements, or any alteration in the details of hospital management, would materially affect the broad result—the death-rate. This could only be accomplished by such changes in medical and surgical treatment as would affect the mortality of the diseases treated. The

Medical Officer of the Privy Council himself, Mr. Simon, has in the body of the Report expressed his concurrence in the main views enforced in this document, which, he says, "gives a substantially just relative appreciation of the present hospital-system of this country."

THE FINANCE OF HOSPITALS.

I had hoped to escape from this subject, as intricate, and perhaps unsatisfactory in its nature; but the question met me at every turn, and I could not avoid it. It will be seen that amongst the best men of our profession, past and present, whether pure philanthropist, or philanthropist and man of business, economy in expenditure has taken the lead in their hospital arrangements. It even precedes the attribute of order. The very existence of an hospital implies a rigorous regard to expenditure; for who can contemplate an extravagant hospital as other than the worst kind of "Red Lion" for invalids—as a house which must fall on the first day of reckoning. However unsatisfactorily the doctrine that "economy is the life of the army" may be carried out in practice, in this country, certain it is that economy is the only sound life of charitable institutions. It precedes all other considerations. In the history of our military expeditions, hospital finance rises continually into view, either as unworthy parsimony or as enormous and unnecessary waste. The proper regulation of this matter is therefore one of the most important of preliminaries in all hospitals, whether civil or military. The waste of hospital funds is no small part, for instance, of overcrowding, by causing every case of sickness or of wound to linger in hospital so much longer than would otherwise be needed.

2. The sting of hospital finance, as of general taxation, is wastefulness; and there must therefore be a power to control and direct expenditure, and to see that money is well spent.

3. But there is another contingency to be guarded against. Looking to the future, there is some reason to apprehend that even charity may be abused amongst us; that our metropolitan charities may become too numerous, so as to exceed the real wants of the population; that institutions of most excellent design may eventually have to relieve each other, for want of other objects.

4. Of charitable institutions, there are in this metropolis, according to the "First Report of the Committee on Beneficent Institutions," about one thousand and two hundred; the medical charities alone relieving upwards of six hundred thousand patients, as in- and out-patients of hospitals.

5. The sums contributed for the support of the medical charities of London and Paris are, by one calculation, as follows (the disproportion representing probably the ratio of the two populations):

LONDON.					
Income of medical charities	.	.	.	.	£308,520
Poor-law	.	.	.	.	842,380
					£1,150,900

PARIS.	
Expenses of l'administration générale, year 1853	£560,853

6. *General Hospitals.* "The fourteen institutions belonging to this class possess an income from realised property to the amount of 109,687*l.*; annual subscriptions amount to 17,091*l.*; their donations to 16,636*l.*; their legacies to 10,206*l.*; and their miscellaneous sources of income to 1,996*l.* The total income of all these hospitals from every source is 155,616*l.*; and the annual contributions of the public amount to 45,929*l.*

7. *Special Hospitals.* "There are thirty-six of these institutions, possessing an aggregate income of 117,218*l.*, exclusive of 79,988*l.* comprised in the fifth column of the table, headed 'Poor-law relief.' Of this sum of 117,218*l.*, endowments and realised property yield 27,140*l.*; annual subscriptions, 12,081*l.*; donations, 28,702*l.*; legacies, 18,993*l.*; miscellaneous sources

of income, 15,385*l.*; and sales and contributions by patients or their friends, 11,333*l.* The difference between the sum of these specified sources of income (113,643*l.*) and the grand total of 117,218*l.* consists of sources of income not distinctly specified in the reports of the several institutions.

8. "It will be seen that the income of the general and special hospitals taken together amounts to 155,616*l.*, added to 117,218*l.* or 272,834."

9. *General Dispensaries.* "Of these institutions, of which there are forty-two in number, the income from all sources is nearly 21,000*l.* The exact sum is 20,988*l.*, made up as follows: endowments and realised property, 2,282*l.*; annual subscriptions, 8777*l.*; donations, 7746*l.*; legacies, 944*l.*; miscellaneous sources, 126*l.*; and sales and contributions from patients and their friends, 1,113*l.*"

10. *Special Dispensaries.* "There are eighteen of these institutions, of which the annual income amounts to 8064*l.*, thus distributed: endowments, &c., 2098*l.*; annual subscriptions, 3146*l.*; donations, 1792*l.*; legacies, 733*l.*; miscellaneous sources of income, 168*l.*; and contributions from patients and their friends, &c., 127*l.*"

11. *Nurses' Training Institutions.* "These useful institutions, which are auxiliary to our hospitals, have an income of 4740*l.*, derived chiefly from payments made by wealthy persons for the services of the nurses trained by the institutions. They derive 3317*l.* from this source; they have 79*l.* of income from realised property; 548*l.* from annual subscriptions; and 796*l.* from donations."

12. *Samaritan and other Funds connected with Hospitals and Dispensaries.* "These funds have an aggregate amount of 1882*l.*, of which 667*l.* is derived from realised property; 159*l.* from annual subscriptions; 758*l.* from donations; and 298*l.* from contributions in aid, &c."

13. *Poor-Law Medical Relief.* "The salaries of medical officers and dispensers, and the charges for such drugs and medical and surgical appliances as are occasionally provided by the guardians, in addition to those salaries, amount to 28,776."

14. *Cost of Maintenance of Pauper Lunatics.* "This amounts to the very considerable sum of 79,988*l.*"

15. *Vaccination.* "The sum paid for vaccination—a measure of precaution belonging to a different class of charities from those now under consideration, but not easy to separate from them—is 4229*l.*"

16. *Summary.* "The annual income of the several medical charities, of such portion of the medical relief under the Poor-law as admits of separation from the general expenditure, of the cost of maintenance of pauper lunatics, and of vaccination, amounts, as will be seen by the following tabular statement, to 423,668*l.*; of which 310,604*l.* consists of voluntary contributions, and 113,056*l.* of sums raised by rates."

17. "General hospitals	£155,616
Special hospitals	117,218
Total hospitals	£272,834
General dispensaries	21,000
Special dispensaries	8,064
Total dispensaries	£29,064
Nurses' training institutions	4,740
Samaritan and other funds	1,882
Total of voluntary contributions	£308,520
Poor-law medical relief	£28,776
Pauper lunatics	79,988
Vaccination	4,292
Total raised by rates	£113,056
Grand total of voluntary contributions and rates	£421,576."

18. "Of the charitable contributions properly so called, about 142,000*l.* is derived from realised property; about 41,000*l.* from annual subscriptions; about 52,000*l.* from donations; and about 31,000*l.* from legacies.

19. "If the population of the metropolis be taken at 2,500,000, the voluntary contributions to our medical charities, including the income derived from realised property, will be at the rate of somewhat less than 2*s.* 6*d.* per head. Taking the same basis of calculation, the annual subscriptions will be at the rate of less than 4*d.* per head, the donations of about 4*d.* per head, and the legacies of nearly 3*d.* per head. But if allowance be made for contributions from persons who are not resident within the limits of the metropolis, even these small sums will have to undergo some abatement."

20. While treating of hospital finance, it is proper to state that the funds of our medical institutions are said, by persons who speak advisedly, to be in course of constant abuse from the admission to their benefits of persons who, by their position and superior means, are undeserving of any charitable relief.

21. To demonstrate the fact, it is only necessary to state that forty-five millions sterling are annually expended, by the labouring classes chiefly, in the purchase of spirits and tobacco; while it is well known to the medical officers of our hospitals that a goodly percentage of the patients derive succour fraudulently, and to the prejudice of the interests alike of the medical officers and of the subscribers to our charities.

22. That the means possessed by daily-increasing classes of labourers and artisans are sufficient, in their years of health, to provide for the necessities of their hours of sickness, and for the infirmities of age, is proved by the readiness with which they join the Benefit-Societies established by public companies and private establishments.

23. By ill-regulated and indiscriminate modes of medical relief, we teach habits of improvidence to the class of labourer and mechanic, and eradicate from their minds the noble characteristic English attribute of self-reliance and self-respect. We do more: by holding out promise of succour, under diseases engendered by debauchery, we encourage the national vice of drunkenness.

24. Our medical charities were not established for the reception of absolute and unredeemed paupers; yet a large proportion of the out-door relief given by our hospitals and dispensaries is thus wrongly diverted. Through want of food and its resulting diseases, they seek for aid, and receive cod-liver-oil, sago, and arrowroot; while the Poor-law relief, which is their proper due, is withheld.

25. "Yes," says the *Medical Times and Gazette*, from whose excellent articles these observations are quoted, "these charities are a sort of sluice, into which the Poor-law authorities turn a large amount of parochial misery, instead of honestly providing for it. What do the bills for cod-liver-oil consumed by this class of paupers in our charities really represent, but so much food, paid for by the governors instead of by the rate-payers?"

26. Under a system better ordered, the mechanic, instead of spending the superfluous part of his wages in drunkenness, and in the production of the many diseases which drive him into hospital, would then become an independent man, receiving what in part he had already paid for, and had a right to claim.

27. "A long experience," says the editor already quoted, "has shown to us that the classes of whom we speak are willing and ready to pay the small sum demanded of them—a sum which would equal half the present expenses of our hospitals and dispensaries—provided they could thereby obtain the superior kind of advice they suppose to be had at hospitals."

28. The relief which can be very easily obtained is seldom valued; and this truth applies in an especial manner to the indiscriminate out-door relief which offers food of insufficient nature and amount, in the shape of medicine, to starving paupers.

29. Three great endowed London hospitals are mentioned^o as possessing each an annual revenue, rapidly increasing, of 40,000*l.*—thus placing at their joint disposal 120,000*l.* per annum. The three institutions together promise a maximum of 1700 beds; requiring for the annual maintenance of each bed 30*l.*, or an aggregate of 50,000*l.*

30. On this calculation, the large sum of 70,000*l.* is left to be annually applied to the relief of about 200,000 out-patients; each of them costing the institutions about six shillings a-head—an extravagant sum for this department of service. This system requires revision, lest it degenerate into a waste of the revenues of those great charities, crippling their usefulness in other and better directions.

CONVALESCENT HOSPITAL.

No system of hospital arrangement, national or metropolitan, civil or military, can be regarded as in any way complete, which does not comprehend the supplementary establishment of convalescent hospitals. All who are acquainted with our civil hospitals, especially with those in crowded cities, know how many patients return home to die, for want of an asylum where convalescence may be promoted and matured into health—where pure air, gentle exercise, and regulated diet may complete what the Surgeon and the Physician have begun. In our hospital arrangements, it is to be feared that we have been trusting too much to drugs, and too little to the influence of pure air.

2. There are notices of remote date in various countries, as Spain and France, of convalescent establishments as attached to, and for the relief of, general hospitals; and we find excellent notices, although not of so early a date, in our own country, such as those of a Society established, in 1791, in connection with the London Hospital. They were founded on the works of Howard the philanthropist, and the principle of their institution professed to be: "Take care of him; and whatsoever thou spendest more, when I come back, I will repay thee." Here we have, in fact, the principle of all sanitary arrangements, which, by a universal and beneficent law, repay themselves; a result so beneficent that it should be ever kept before the public eye.

3. Charity should not be exclusive or limited in its application to distress, nor should its objects in relation to disease fall short of a complete restoration to health. Hospitals are a practical example of that charity which has been compared to the bounty of Heaven, and to the hand of the Creator, which is never closed.

4. By charity we understand a virtue which, like generosity, supposes the sacrifice of personal for foreign interests. Charity is not only a duty of humanity, but more; one of the most pointed obligations of society towards some of its members, to whom it owes every thing, when they can do nothing for themselves. This is not said with the view to deprive governments of their merit when they occupy themselves with public charity; on the contrary, to speak of the duties of governments is to show them, if not the only, at least the most solid, title of their glory.

5. All we can wish, as regards the poor, is, that they accept and enjoy, without the fear of humiliation, the succours which charity offers them; and for this it is only necessary that they know they have right to those succours.

6. It is doubtful if any estates were ever devised, or any money bequeathed, which bore richer fruit or produced greater blessings than hospital endowments. When it is remembered that in those establishments any poor invalid or sufferer, with no claims but his sufferings, finds the best treatment, the best food, the best advice that can be given—all indeed which the most unbounded wealth could buy—it will be seen how truly they reflect honour upon the country.

7. But hospitals are not complete or perfect any more than other human

* *Medical Circular* of 27th February 1860.

institutions; and one of the greatest wants of our noblest institutions must be reckoned the absence of convalescent establishments. The "desperation," the natural craving for "variety," so graphically described by Miss Nightingale as characteristic of all sick persons, must of itself have proclaimed to the observant physicians of all ages and countries the necessity for convalescent hospitals; that is, for a relief from the horrors of the hospital miasm of the great town system. Miss Nightingale's description of the labouring man who was desperate "to see once more out of window," and who got on the nurse's back "to see out," is demonstrative of a physiological truth, because it is an instinctive impression. The desire for change, for change in every thing, physical and moral, which is implanted in our nature, is increased a thousandfold by sickness; and the denial of this instinctive craving is unquestionably a most powerful cause both of retarding convalescence and cure.

8. "An hospital," says Dr. Rollo of the Artillery, "should be regarded as a place exclusively devoted for the reception and treatment of the sick and wounded; but when convalescence arrives, a change of place and of management becomes necessary to the advancement and reestablishment of health. When the sick begin to feel the dawn of health, the mind becomes sensibly changed, and disgust takes the place of accustomed associations and modes; and hence a disposition is formed inimical to recovery.

"When this stage arrives, if they are removed from hospital to the place of convalescence, where they are to associate with different persons, to engage in other and new manners, and to be sensible of a complete change of scene and of habit and accommodation, the recovery advances rapidly, and proves complete. These observations apply to any description of sick; but more especially to the soldier."

9. Convalescent hospitals are spoken of by Donald Monro as in general use throughout the army in his day, and he lays down excellent rules for their management. How this inestimable aid fell into disuse in the army does not appear. Robert Jackson, writing in 1803, recommends "separate and detached houses," and the removal of convalescents "to other apartments or hospitals." He adds that innumerable proofs occurred in his experience of soldiers "recovering health better and sooner in sheds, huts, and barns, exposed occasionally to wind and rain, than in the most superb hospitals in Europe. Pure air, in this respect, is alone superior to all forms of cure, and to all other remedies without such aid."

10. This great author every where speaks of "relapse as the leading cause of mortality in general hospitals. . . . The effect of accumulation is evidently to corrupt the air, and thus to generate an artificial malignity; life is lost, and the cure is protracted; independently of which the military qualities of the surviving soldier, as depending on discipline and impressions of energy from example, are impaired, if not totally destroyed."

11. In hospital the soldier is under a necessary restraint; and were he discharged from it immediately on the subsidence of disease, to inhabit the common barrack, he would feel and act as the schoolboy at his vacation, and enter with all the recklessness of his nature into enjoyments the most injurious to his health; and hence frequently those relapses so much more dangerous than the original disease.

12. The convalescent hospital is therefore a stage in the process of cure, intermediate between the hospital and the home of the citizen and the soldier. In either case the sick and convalescents are gradually and surely brought back to their habits of health, and the duty of the physician, whether civil or military, is duly performed.

13. In the convalescent hospital there must be separate and equally well-ventilated apartments for the refreshment of sleep and for that of meals, besides covered ways for exercise in bad weather, and open spaces for exercise in fair weather. The scale of diet must also rise with the advance towards health.

14. The miasm was so concentrated in some of the Italian hospitals that,

out of fear of its effects, convalescents were not deemed safe in their neighbourhood; the patients were therefore sent into the country and lodged in separate houses. Where practicable, a certain number of convalescent hospitals should be constructed on the seaboard.

Postscript. Perhaps the most complete institution of the kind here referred to is that founded in August 1857, at Vincennes, by the Emperor Napoleon III., and which contains 411 beds. The edifice is composed of a main building, with two long wings, two stories high, with a ground-floor. It has ample garden-ground, basins, and jets-d'eau.

2. In the two years and ten months of its usefulness this hospital has administered relief to 14,000 convalescent artisans.

3. The central pavilion, Dr. Véron states, contains on the ground-floor the chapel, and to the right and left airy dining-halls, having marble tables, commodious seats, and simple service reduced to necessities. Every object in these refectories is bright with cleanliness.

4. On the first-floor of the central building are the library and play-room; the two wings of the edifice in both stories being subdivided into rooms, each of three beds, all neatly furnished, and looking to the south. Each patient has the use of a press with lock and key.

5. Every where open air and sun are freely admitted; and even in the store-houses permanent ventilation is maintained; consequently nowhere, even in the best houses, is linen to be found drier or fresher than at the asylum. It is completely inodorous.

6. The convalescents belong to the following categories:

(a) To the hospitals of Paris and its suburbs.

(b) To charitable boards.

(c) To convalescents from wounds received in the public dockyards.

(d) Members of benefit-societies.

(e) Operatives from establishments paying subscriptions, and whose directors are authorised to send their convalescents to the asylum.

(f) Artisans treated at their own homes on presentation of certificates of convalescence by their medical attendants.

7. The mean duration of the stay at the asylum is twenty-two days. Convalescence from typhus fever is comparatively short, in consequence of the hygienic resources of the institution.

8. In principle, the convalescent remains at the asylum until he is completely restored to health, or declared incurable.

9. The diet is regulated by the director and head-physician of the establishment; the habits of the artisans being adhered to for the hours of meals.

10. At 7.30 A.M. soup is served; and at 10.30 meat and vegetables. At 5 P.M. soup, roast meat, vegetables, and salad or dessert are served; each convalescent receiving a pint of Burgundy wine, and as much bread as he may choose. The head-physician modifies this diet whenever he thinks fit.

11. When convalescents desire it, they are employed in the establishment, receiving wages of from two to five pence per day, and an extra allowance of half a pint of wine. Some thus lay by a small sum which proves a useful resource on leaving the asylum.

12. The allowance for food for each patient per day is 11*d.*, exclusive of the general expenses and of firing; the daily cost of medicine for each convalescent averaging 1*d.*

13. The medical service is complete, and comprises common baths, sulphurous, saline, and vapour baths; the administration furnishing also bandages and such other apparatus as the convalescents cannot afford to purchase.

14. On arrival, and being examined by the house-surgeon on duty, convalescents receive the clothing and linen of the establishment, which usually comprise shirt, greatcoat or smock-frock, socks, nightcap, a cloth cap or straw hat, a napkin, towel, and handkerchief. The linen is changed every Saturday, being washed and ironed in the asylum.

15. A wash-house is established on Bouillon-Müller's system, and comprises a five-horse-power steam-engine, wash-tubs, coppers, a cold-water boiler, a centrifugal-force drying-machine, hot-air drying-rooms for winter, and a drying-field in the open air for summer.

16. Unoccupied convalescents find numerous means of diversion; they have at their disposal skittles, balls, drafts, dominoes, *loto* : cards are prohibited.

17. The library is open every day from 12 to 4, and contains 4000 volumes and the illustrated journals. The greater part of these books were presented by the Paris booksellers as donations. On the average there are 50 readers a-day; and there have been as many as 96.

18. The bearing and general conduct of the inmates is exemplary; submitting without murmur to the regulations, being polite to each other, and respectful to the officers of the establishment. They are careful of the furniture, garden-flowers, &c.; and keep their rooms and passages in great cleanliness.

19. The officers of the asylum of Vincennes are—a director, treasurer, head-physician, and three house-surgeons; six nuns of the Order of St. Augustin of Belgium; a chaplain, five clerks, a store-keeper, four overseers, and forty subalterns.

20. The head-physician has the charge both of the medical and surgical departments; and upon his and the directors' nomination the house-surgeons are appointed by the Minister of the Interior.

21. Sunday, Monday, and Thursday are the days on which relatives and friends are allowed to visit the convalescents; and the parlour or garden may be used for this purpose.

J. R. MARTIN.

SURGICAL INSTRUMENTS AND APPARATUS.

THIS essay on "apparatus" does not pretend to be a complete enumeration of modern surgical instruments and appliances. There is no space for such an enumeration; nor would it be compatible with the objects of the present work. The series of observations on instruments generally, which follows, is intended merely to put before the reader such as appear best calculated to effect, in skilful hands, the desired objects.

It may be remarked that proper names are rarely introduced as applied to instruments. Such a practice leads only to dissatisfaction and argumentative claims for priority of invention. The reader, however, may be assured that our surgical forefathers were not idle—and that many a so-called novelty may find its prototype in the past.

The objects here sought are to afford the Surgeon plain and practical rules for guidance in the selection of instruments. Very many varieties, however, will be found mentioned in the several essays which form the foregoing System of Surgery, by their respective authors, whose names are a sufficient guarantee for the soundness of their advice and opinion.

Pocket-case. A Surgeon's pocket-case should, for convenience, be as light as possible; but must contain those instruments required for immediate use, namely, two broad scalpels (one double-edged) fitting into a single handle; two curved bistouries (one blunt-ended) similarly set; a pair of scissors, a spatula, two lancets, two probes, a director, a pair of dressing-forceps, a pair of artery-forceps, a tenaculum, a gum-lancet, a female catheter, and a caustic-case.

The scalpels are used commonly for opening abscesses, such as those which form in the deep-seated structures of the neck, in the palm of the hand, by the side of the rectum, &c.; and inasmuch as it is desirable to let out the matter effectually, with as little pain to the patient as possible, so the

knife should be sharp-cutting, thin, and broad, that it may enter and divide the soft parts swiftly and easily, and make with one plunge an opening nearly sufficient in extent. When a small knife is used, the enlargement of the opening is effected by a succession of movements, which leave a jagged wound. Let it also be remembered that it is the size of the abscess, and not the age of the patient, which determines the breadth of the knife. The usual scalpel may be as freely used in an infant as in an adult. The scalpel with a single cutting edge is rarely used; for in operations of magnitude a special set of instruments is required. Still it may be needed, and should form part of the usual pocket-apparatus.

The scissors should cut well to the point. Some Surgeons carry two pairs—one for plasters, the other for operations. Those for the former purpose may be made with the blades bent at an angle.

In the surgery of hospital practice, the curved bistouries are required generally for slitting-up unhealthy sinuses proceeding from badly-managed suppurating buboes; for dividing the contracted prepuce in sloughing ulcers of the glans penis; for laying open a fistula in ano, &c. Care should be taken that these instruments be sharp.

Bleeding-lancets are not often required for the purpose intended by their name. Venesections in the spring of the year have grown out of fashion, together with the biennial exhibition of purgative medicines. A bleeding-lancet is now mostly used for opening very small abscesses, for vaccination, &c.; and no Surgeon should be without two or more of such implements.

Probes are usually made of silver,—the reverse end of one being sharp, that of the other having an eye; but a steel probe is a useful instrument: it is firmer when used for the examination of carious bone, or for the search after foreign bodies.

A director is usually made of silver, the handle end being flat and sometimes fissured. This fissure was used by the older Surgeons to protect the ranine artery in division of the frænum linguæ. A flat steel director, as invented by Mr. Wormald, is a useful instrument in the division of very tight strictures, such as that of Gimbernat's ligament in femoral hernia, and may be added to the case.

The dressing-forceps should be made much stronger than the common ones, inasmuch as they are required for the removal of pieces of dead bone, or for grasping foreign bodies, when the exercise of considerable force is necessary.

Fig. 1.



There are many varieties of artery-forceps, the greater number of which profess one and the same object—that of holding the bleeding vessel by some spring or catch, so as to allow the Surgeon, when without an assistant, to have both his hands at liberty to apply the ligature. One of the most durable instruments is fixed by a slide-bolt; another, on the principle of Assalini's forceps, closes by a spring; (fig. 1) a third opens with a spring, the blades being held together, when grasping the vessel, by means of a catch. Of these, perhaps the last is the most handy. It is particularly useful in the performance of the operation of harelip. The minutest piece of the lip can be held surely and firmly while the requisite incisions are being made.

Acupressure. As a substitute for the ligature applied to an artery to restrain bleeding, Dr. Simpson of Edinburgh has lately proposed the employment of a needle to close the bleeding vessel by pressure till a coagulation-clot has been formed.

In using the ligature, the part of the artery and any of the soft structures enclosed are necessarily strangled and die before it can be disengaged. For periods varying with the magnitude of the vessel, the ligature remains as a foreign body; excites by its

presence ulceration of the artery just above the constriction; imbibes and retains fluids which may decompose, be reabsorbed, and contaminate the blood.

For all these reasons its presence in a wound is prejudicial to union by adhesion, and to organic closure of the vessel, and, in addition, increases the risk of purulent infection of the vital fluids.

Metallic surfaces are practically impervious to moisture; and, as a matter of observation, it has long been known that metallic substances may be introduced and lie imbedded in the soft structures of the body for an indefinite period, without producing suppuration or even irritation.

Again, it is a matter of observation that by pressure sufficient to interrupt the stream of blood through an artery for some hours, its channel becomes occupied by a clot of blood reaching as far as the mouth of the next considerable branch given off from it; and that, under favourable circumstances, this clot may be organised and permanently close the vessel.

From these data Professor Simpson concluded that it was feasible to pass a needle through the soft structures in such a manner as to press upon an artery divided at some distance from any collateral branch, and so close its channel till the Surgeon considered he might safely withdraw it, and leave to nature the complete obliteration of the vessel.

For this purpose he proposed to use the needle in any of the three following modes:

1st. By passing a *long* needle through the soft parts on each side of an artery, so as to cross over and compress it in the same way as in fastening a flower, by means of a pin passed over its stalk, in the lapelle of the coat. The needle should have a glass head for facilitating its introduction and removal; and when inserted, the head must be outside the wound.

2d. A *short* common sewing-needle, armed with fine iron-wire, is dipped down into the soft textures a little to one side of the vessel, then raised up and bridged over the artery, and again thrust into the soft tissues on the other side. The iron-wire serves to withdraw the needle, and is to be carried outside the wound.

3d. A *short* common sewing-needle, armed with iron-wire, is passed through the soft part on each side of the artery, and immediately *behind* the vessel, for a point of resistance; the head and point of the needle are to project so as to allow of the wire being carried *over* the artery, turned round the needle's point, and returned to its head, where it is to be fixed by a twist. In this way the artery is pressed between the needle and the loop of wire.

To remove them, the needle may be withdrawn after cutting the wire near its eye; the loop, being disengaged, may then be easily pulled through the wound.

Very little pressure is required to control bleeding, even from one of the large arteries; the Surgeon should therefore avoid undue obliquity in passing the needle, lest it produce ulceration of the coats of the artery, and of the soft textures in its track.

As yet, probably no definite rule can be suggested as to the period when the needle should be removed; but it seems that a few hours' pressure will suffice for such arteries as the radial or ulnar, and when applied to the femoral, in amputation of the thigh, for about fifty hours. In a case reported by Mr. Crompton, secondary hæmorrhage occurred after seventy hours' pressure; and after death it was observed that the femoral artery was quite empty to the point of constriction. The patient died of pyæmia.

Acupressure has proved successful in the practice of many Surgeons when employed in the larger amputations; and in the Carlisle Hospital secondary hæmorrhage has been more uncommon after it than when the ordinary ligature was used.

The *female catheter* is a necessary addition to the pocket-case, since retention of urine sometimes complicates operations performed on, or in the neighbourhood of, the pelvic organs; and the catheter may also sometimes

perform the part of a sound in detecting the presence of foreign bodies. Retention of urine does also sometimes occur from injury to the urethra, and occasionally, though still more rarely, from organic stricture. The introduction of instruments, however, in hysterical retention is injurious and objectionable, and has been reprehended in the essay on HYSTERIA, vol. i. p. 365. In introducing the catheter in an adult, it is desirable in ordinary cases to avoid any exposure of the patient's person; and there is usually no difficulty in finding the meatus without any such exposure. On passing the finger down below the clitoris, the projection of the meatus is easily felt just above the entrance of the vagina. The index finger of the left hand should be placed below this projection, and the catheter, glided along the finger, will find its way into the meatus. In children there is not the same objection to exposing the parts; but if the Surgeon prefers to pass the catheter beneath the clothes, he must remember that the urethra appears to be situated much farther back, in consequence of the relatively small size of the vagina.

Of the other instruments,—tenaculum, gum-lancet, and caustic-case,—the last only merits remark. The metals best fitted to hold the caustic without corroding are palladium or gold. The former lasts extremely well. Sometimes a small trocar is fitted to the reverse end of the caustic-case; but to this there is an objection that it is very apt to rust, and to cling so tightly to the minute canula, that it cannot be used.

Finally, a Surgeon's common pocket-case should be made to close by any other means than a spring-clasp, which always gets out of order. A single pocket is sufficient for ligature-silk (of which there should be two or three varieties) and needles, which should be sharp and of different sizes and curves.

Those who have to visit patients in outlying districts may have a male catheter added to the above. It should be of the size of No. 6, and separable into two pieces, which are united by means of a hollow screw lying in that portion which would be called the handle. A piece converting the handle into a female catheter is made of the same gauge.

If the pocket-case contain more than the above, it becomes inconveniently heavy. The instruments should be so arranged that they do not press against one another when the case is closed; for then an accident is apt to produce marks and indentations on silver instruments, such as a catheter or caustic-case, and occasionally to render them unfit for use.

Many cases occur in which it is desirable to explore the interior of a tumour; and for this purpose a grooved needle, enclosed in an ivory case, is made so as to be fitted into some convenient part of the case, perhaps where the pencil was supposed to be.

In some hospitals the Surgeons are fond of using a small knife, not unlike a tendon-knife, in doubtful cases of abscess. It goes by the name of "Pollock's abscess-knife." It is a very narrow-bladed, but not very thin, scalpel, double-edged for a very short distance from the point, mounted in a little tortoiseshell handle, with a spring: it takes very little more room than a lancet. It is so small that an exploratory puncture can be made with it, and yet strong enough to make a tolerably long and deep incision.

The *écraseur* of M. Chassaignac is a long steel instrument containing a chain, which, passed round the base of any structure, gradually constricts it, and slowly tears through the compressed tissues by means of very simple machinery worked at the handle. When used in properly-selected cases, it possesses certain advantages. It may remove a large tumour without the occurrence of hæmorrhage; for torn and compressed arteries do not bleed. It may cut through the base of a polypous growth, in cases where the employment of the knife would be dangerous; and, by removing the morbid structure, spare the patient the discomfort and risk attending the separation of the constricted parts by sloughing. *Ceteris paribus*, the employment of the knife is preferable as being quicker.

The best form of instrument is that which works with a handle at right

angles to the shaft of the instrument. As the right or left half of the instrument is depressed, one link of the chain is pulled into the case. The great object is to work slowly, one quarter to half a minute intervening between the successive movements; but it is not necessary to abide by this rule, unless the resistance be considerable. Another form of the *écraseur* is supplied with a handle like a ship's wheel. The shaft may be straight or curved; the chain may be of different sizes.

The galvano-caustic "cutting-noose" (fig. 2) is made of platinum wire, which is passed round the neck of the part to be removed; next rendered burning hot by being attached to a galvanic battery; and finally tightened by a screw, so as to cut through the soft parts. The instrument here represented is ten inches long, and is composed of a broad ebony handle of four inches long (*a*). From this proceed two batteries (*b b*), each of which has attached to its anterior extremity an octangular transverse piece (the capital, *c c*). These receive the tubes (*d d*) vertically, and the lateral pieces (*e e*) horizontally; and these latter are attached by the quadrilateral extremities to the conducting chains. The ligature-tubes (*d d*) are $2\frac{1}{2}$ - $6\frac{1}{2}$ inches long, and 1 inch broad; straight or bent; and isolated by means of a piece of ebony (*f g*) inserted between them. This piece of ebony should send a tongue-like prolongation to isolate the two capitals (*c c*), and end in a head (*f*), which is perforated for the ligature-tubes. When the piece (*k*) is drawn backwards, the transverse bar (*i*), to which the platinum wire is attached, can be taken out.

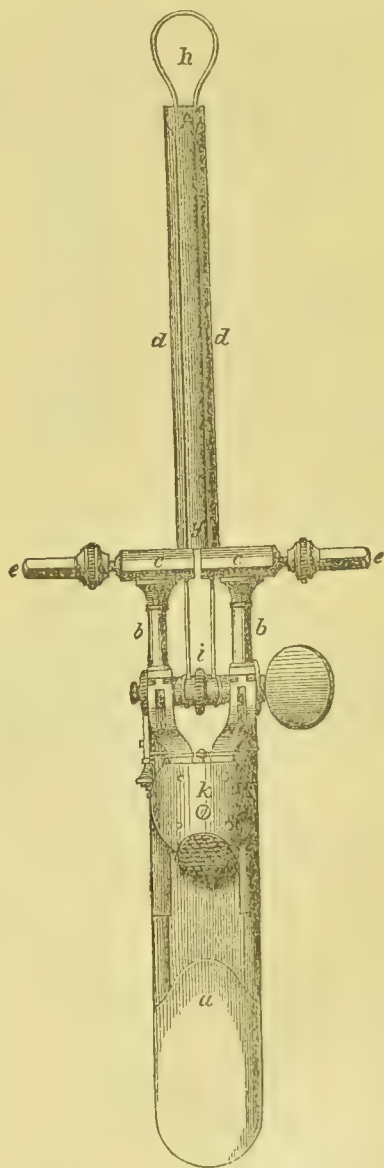
Among modern instruments for including within a ligature the base of a tumour is Maisonneuve's apparatus, which works by means of a long screw in the centre of the handle.

Needle-holders, by Bruns and Lüer, have been recently exhibited, of ingenious construction, the blades becoming closed as the handle is withdrawn within the canula.

Polypi-forceps of great strength have been constructed. In some the handles are fixed in a catch as they are closed, and the operator has thus both hands free, if he so needs.

Aural instrument. An instrument has been constructed for the purpose of removing foreign bodies from the ear. It consists of a straight piece of steel about the shape and size of a small director. The tip of the instrument is made to bend downwards to a right angle, when acted on by a screw at the handle. The principle consists in passing the instrument down the meatus auditorius, until the point has passed the foreign body. The depression of the tip then converts it into a sort of hook, which will readily serve as a means of traction. But, as has been shown in another place, foreign bodies, if they do not act as sources of irri-

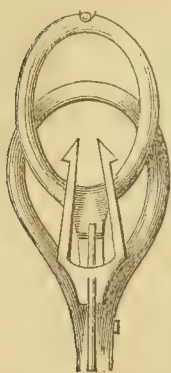
Fig. 2.



tation, may be allowed to work their own way out from the auditory passage.*

Instruments for operating on the enlarged tonsil (fig. 3). In the present day an instrument called the guillotine is mostly used for this operation, and it accomplishes its object perfectly. There are two varieties. One, the original, which cuts from before backwards; the other, of later date, which cuts in the opposite direction. The principle is the same in both. A steel frame is grooved so as to allow passage for a knife, shaped as the guillotine-knife. The end of the frame is slipped over the tonsil, the projecting part of which is seized with a hook; the knife is then pushed backwards to the end of the frame, cutting through the tonsil in its course. The only accident which can occur is that the piece of severed tonsil may become detached from the hook and slip down the patient's oesophagus. The steel frame may contain a thin curved knife at its end, concealed within the apparatus. A double movement, effected at the same moment, enables the Surgeon to plunge a harpoon-shaped hook into the tonsil by the pressure of the thumb, while he draws the thin semilunar knife from behind forwards through the tonsil by the action of his fingers; and the operation is completed in a second. The first instrument requires three periods for its use: first, passing it over the tonsil; secondly, fixing the tonsil with a hook; thirdly, cutting the gland with the knife. The second instrument requires but two periods: first, slipping its end over the tonsil; the insertion of the hook and the action of the knife are simultaneous. Both are instruments of great merit; the former being American, the latter French. Of the two, the latter is the more complete, because more speedy in its action.

Fig. 3.



The instruments used in operating for *hernia* have been already described (p. 278).

Amputation case. No great improvements have been lately made in the instruments contained in an amputation case. The contents consist of knives of different sizes, including the catlin, a tourniquet, saw, artery-forceps and bone-forceps, scissors, and ligatures. Of the knives it may be remarked that they should be straight, moderately broad, and not too long, lest they be unmanageable. A small amputating-knife is preferable in operations at the lower third of the leg, or at the ankle-joint, the foot, or arm. A similar instrument is desirable in reflecting back a semilunar flap of integument, or in the performance of Mr. Teale's operation of the rectangular flap. A modification of the steel tourniquet has been invented by the late Mr. Skey, jun. It consists of several pieces, which yield so as to allow the pad to press properly on the artery.

The screw tourniquet of Petit may be improperly applied for want of attention to a simple rule. The screw which tightens the bandage must be *precisely opposite* to the pad which presses on the artery. If it be not so, then at each turn it drags obliquely on the pad, and the artery slips from pressure. If the pad does not exactly fit the limb, a piece of folded lint may be inserted under it. A complete case should be supplied with a compress attached to a handle for compressing the subclavian artery just above the clavicle or the external iliac as it passes over the pelvis in cases where the usual tourniquet cannot be applied. Among other useful instruments is the field tourniquet of Assalini.

The instrument called "Butcher's saw" merits attention. It consists of a fine steel saw, made of material like watch-spring, but of some breadth, fixed in a steel frame, to which the usual handle is attached. The peculiarity is as follows: the Surgeon may turn the cutting edge to any angle he pleases;

* Vide essay on INJURIES OF THE FACE.

and may thus saw in a semicircle. In taking off the spine of the tibia after a limb has been amputated, or in rounding off any sharp process of bone, this instrument, which has been constructed chiefly for cases of excision of joints, is most useful. It is likewise an excellent saw for cutting through the metacarpal or metatarsal bones in operations on either the hand or foot.

A saw with "folding back," called "Fergusson's saw" (fig. 4); another with

Fig. 4.

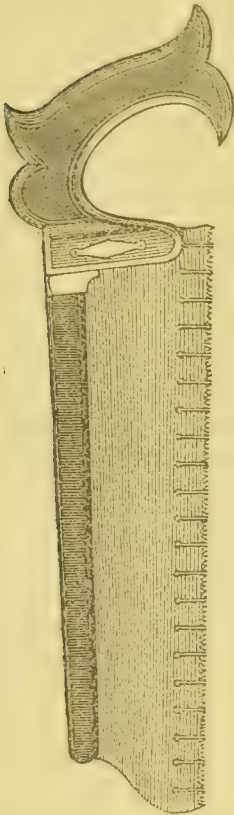
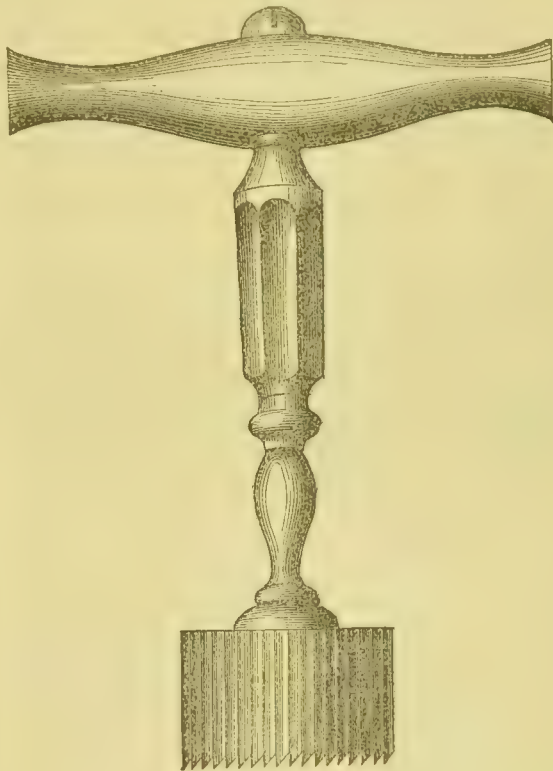


Fig. 5.



slits in the blade, having the effect of clearing the teeth of the saw during the operation (introduced by the Messrs. Weiss); the bow or frame saw, as common in dissecting apparatus; and the chain saw,—have all their merits as applied to particular operations.

Trephine (fig. 5). Depressed bone may be raised by means of an elevator, and any projecting ridge removed by Hey's saw. The circular saw of the trephine is usually worked upon a centre-pin; and when from any cause, such as deficiency of bone, this pin cannot be used, the difficulty which the Surgeon experiences in making the saw form a groove for itself on the smooth round skull is very great. A case in which this difficulty was experienced suggested the idea of the construction of a saw worked within a case, which might by pressure be held firmly on the skull for a time by means of three sharp-pointed steel pins.

A very useful modification of the trephine is made by Messrs. Weiss by adding a "multiplying stock" with rosehead and small trephine saw to the ordinary case of bone-instruments. By means of that instrument a thick bone may be expeditiously and safely perforated. A movable collar may also be added to the trephines, by which their action may be regulated; so that when the skull is perforated there is no danger of injury to the brain, as has happened in the practice of more than one eminent operator.

The rosehead is a most effective gouge for removing carious bone, as well as a very convenient instrument for enlarging cloacæ to allow of an exploration for sequestra.

The operation of trephining consists in the perforation of a bone by means of the small cylindrical saw, the trephine, and the removal of the piece of bone so separated.

It is practised on the skull on account of fractures of the bones, 1st, when a portion of bone is depressed and encroaches on the cavity of the skull, producing compression of the brain, and the fragment cannot otherwise be raised; 2dly, for punctured fractures, by which the inner table is splintered, separated from the outer table, and lying loose on the dura mater; 3dly, for effusion of blood or of inflammatory products between the bones and membranes, or between the latter and the brain, the result of injuries, when it is presumed that the effused fluid may be evacuated by the opening; and lastly, on account of epilepsy or other affections, when there is reason to believe that the disease depends on a local cause that may thus be removed.

It is an axiom that the operation is not justifiable except as the last resource of surgery in extreme cases, for the operation itself may destroy life.

Again, it is a well-established principle that as little bone as possible should be removed in effecting the object of the operation.

If there is no wound of the scalp, the hair must be closely shaved over an area of two or three inches in diameter; then the soft structures are to be divided down to the pericranium by crucial incisions, so as fully to expose the bone and afford space for the saw. The old Surgeons insisted on the pericranium being raised from the bone over the space where the trephine is to be applied. This is unnecessary; but if the operator wishes, he may place the saw on the skull and run his scalpel round it, so as to divide the membrane to the exact extent required. He then prepares the trephine by causing the centre-pin to project about one-eighth of an inch beyond the crown of the instrument, and fixing it in that position by tightening the side-screw. He now places the trephine on the bone, and causes the centre-pin to bore an aperture so as to fix the crown of the trephine till a groove has been cut, in which it will work. The sawing is effected by partial rotations of the trephine backwards and forwards, with a light hand. As soon as the groove is deep enough to retain the saw, the centre-pin must be raised, as it would otherwise be in danger of wounding the membranes, &c. The rest of the bone is to be divided by very cautiously continuing the operation, examining the groove from time to time by means of a quill cut as an ordinary tooth-pick, so as to ascertain when the thickness of the bone has been reached.

If the saw has cut through in one place, it should be inclined to the opposite side; and, after a few more turns, the circular piece may be raised, probably, by means of the elevator, and the membranes will be exposed. If the object of the operation has been the evacuation of blood, &c. it will be necessary to divide the dura mater and arachnoid, unless they are already opened.

But how can the Surgeon satisfy himself that blood or serum has been effused so long as the membranes are entire, and thus justify any further proceedings?

It must be admitted that cases occur in which it is very difficult to decide this question, and experienced Surgeons have been at a loss how to solve the problem.

If blood is effused immediately under the dura mater, that membrane appears of a darker colour than ordinary, and may be protruded into the aperture; if serum only is present, the Surgeon must be guided by the presence or absence of the protrusion and of the rhythmical motions of the brain. At any rate, in a doubtful case the dura mater should be very cautiously incised, so as to produce as little mischief as possible.

If the operation has for its object the removal of a piece of depressed bone which cannot be raised by the elevator or forceps, and which does not

allow of the employment of one of Hey's saws, by which an angular portion might be removed, the Surgeon should sacrifice as little as possible of the sound bone. He cannot apply the trephine to the loose fragment, and must therefore so far encroach on the margin of the fracture as to fix the centre-pin on a firm basis.

He will therefore of necessity remove more of the sound bone than of the fragment; but in many cases he may succeed in obtaining space for the elevator without removing the entire circle of bone or without cutting through both tables of the skull; for as soon as the outer one is divided into the diploë, it may be removed by the elevator, and all risk to the membranes may thus be avoided. Still it is better to take away the whole segment than use much force in the elevation of the fragment, as more injury might be done to the brain or membranes.

All loose fragments should be removed; but it has been decided by the highest authorities that splinters of bone or even foreign bodies ought not to be taken away if their removal would produce much bruising or laceration of the brain or of the membranes.

If there is no bleeding, the wound may then be closed by replacing the flaps of integument, and applying lint dipped in water, and a light bandage to afford gentle support. But if there be hæmorrhage it may be allowed to continue so long as it is not producing much impression on the force of the circulation; with this view a piece of wet lint merely laid on the wound will suffice.

Necrosis instruments. Modern conservative surgery demands the removal of portions of dead bone from the shafts of long bones, and the partial removal of the short ones when carious, instead of the summary remedy of amputation. The Surgeon therefore requires an assortment of instruments for making such passages into the bone-case enclosing a piece of dead bone as will allow of the introduction of forceps, &c. for its removal.

These comprise the trephine and other saws of various sizes, and sets of bone-cutting forceps and chisels, for making or enlarging the apertures, and gouges for excavating the spongy bones.

The cutting forceps should include the ordinary straight ones, a pair curved on the flat and having wide jaws, and others known as angular forceps.

The retaining forceps should be of two or three sizes, one being bent at an obtuse angle, and an elevator should be added.

The "lion forceps" of Fergusson is a most useful instrument in many operations on the bones. It is a strong straight forceps provided with two sets of teeth, set at some distance apart, by which it obtains a firm hold on a bone, and enables the operator to steady it while applying the saw or other means for its removal.

In such operations as excision of the superior maxilla, or of one of the bones of the tarsus, it renders the Surgeon very effective service, and as a means of fixing a bone in amputation for a compound fracture it is invaluable.

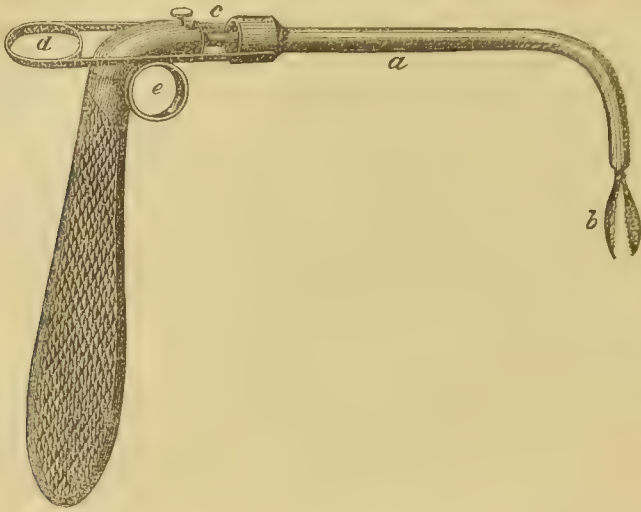
Indeed it is applicable whenever the object of the operator is to seize any thing too hard for the employment of the ordinary forceps, as an enchondroma, osteo-fibrous tumour, &c.

The *laryngeal canula forceps* (fig. 6) is an instrument admirably adapted for removing small growths from the interior of the larynx and neighbourhood of the epiglottis. It consists of a bent rod terminating in a pair of small spring forceps, which separate by their own elasticity, and are closed by passing the canula over them. The rod and canula are attached to a handle placed at about a right angle to their axis, and the canula is moved to and fro by means of a ring, through which a finger may be passed.

The direction of the forceps may be altered to any angle required, and the curvature may also be increased or lessened as desired, as the canula is made of a flexible material, and the rod jointed to enable it to adapt itself to the curve of the canula.

A set of two or three curved canulæ for the trachea is an indispensable addition to the armamentarium of the Surgeon.

Fig. 6.



However the operation of tracheotomy may be done, a canula is required to keep the lips of the wound patent. They are now generally made double, one tube passing into the other, so as to allow of cleansing without the risk of removing the canula altogether from the trachea.

A very useful addition consists in a blunt conical trocar to fit each canula, and assist in passing it into the trachea through a small wound.

There can be no doubt that many of the canulæ to be found in the shops of the instrument-makers are of too small a calibre to allow of the passage to and fro of sufficient air for the purposes of respiration. To obviate this, Dr. Fuller invented a canula consisting of "a bivalve tube, so made that it may be introduced closed, the blades being expanded by means of a spring as soon as its insertion is effected. The shape of the instrument is such as to readily allow of its admission; its size when opened large enough to permit a free passage of air, and it is so constructed as to prevent obstruction from mucus."*

The *laryngoscope* has been fully described at vol. iii. p. 251.

Two or three pairs of curved forceps are required for removing foreign bodies that have become fixed in the fauces or pharynx. The forceps are made to open from side to side, or from front to back, so as to enable the Surgeon to seize any substance placed across this passage.

The probang is necessary to push down into the stomach any foreign body that can be safely and expeditiously removed by it.

The stomach-pump, to which may be appended an enema apparatus, must also be at hand. The self-acting instrument made by Weiss and Son, which requires but a turn of the valve for alternating its action, is probably the simplest and most useful one in operation. If the Surgeon wishes, he may have it made to fit his catheters, and can also have nozzles adapted for injecting the meatus of the ear, &c.

A set of elastic œsophagus bougies is necessary for the treatment of strictures in that canal.

Three or four graduated trocars and canulæ are needed for paracentesis of the chest and abdomen, as well as for tapping hydroceles, &c. The canulæ should be adapted to a brass syringe, or to the stomach-pump, for injecting

* Vide, INJURIES OF THE NECK, by Mr. Gray, vol. ii. p. 314.

fluids into the cavity of a hydrocele or cyst. The trocars and canulæ of Thompson and Wells, for excluding air while used in the evacuation of fluids from the chest and abdomen, are well adapted for their purpose. They consist of canulæ to which elastic tubes are joined for carrying away the fluids, and of contrivances by which the trocars may be withdrawn beyond the junction of the elastic tubes, without permitting the entrance of air into the canulæ. The tubes may be filled with water to exclude air from the apparatus entirely, and when in operation the lower end of the tubes should dip into the fluid. By means of them the pleural cavity, peritoneal sac, or an ovarian cyst may be tapped without the risk of admitting air into those cavities; or they may be used in opening a large lumbar or psoas abscess, or a distended joint.

For examining the rectum and vagina one or more of the various kinds of tubular specula is necessary. Those that expand gradually by means of a screw attached to the handle of the instrument are very convenient for operations within the vagina. The smooth conical metal ones are suitable for the rectum.

For the operations in the rectum, the Surgeon must have a set of bougies for dilating strictures; forceps or hooks for drawing down hæmorrhoids, and strong scissors or shears for excising them. Two or three needles, having their eyes near the points, and set in handles, as used for applying ligatures to *nævi*, are very useful in operations in the rectum.

No instruments are of more importance to the Surgeon than those used in operations in the urethra and bladder. They are of infinite variety—the products of the ingenuity of many of the greatest operators of all times. To enumerate them would require much time and space; such only as are adopted by Surgeons generally will be noticed here, without any disparagement to others.

In the first place, a good set of about eight or ten silver catheters, having wooden handles, as recommended by the late Sir Benjamin Brodie, should be in the possession of every Surgeon. One or two small ones for children are also very often required. A very long one, having a large curve, will often be needed for cases of enlarged prostate gland; a double-way catheter for injecting the bladder; and one, opening at the extremity, and fitted with a flexible metal piston for use when the bladder contains blood-clots, is very serviceable.

In addition to these, the Surgeon should have a dozen elastic catheters, in graduated series, fitted with wire stilettes, and a few straight solid bougies.

For tapping the bladder per rectum, he requires the curved vesical trocar and canula. All these instruments should fit one or more nozzles of a syringe, and a set of soft-wood conical plugs should be kept to close them when required.

The Surgeon will often find it very convenient to be provided with a small bottle of oil in his catheter case.

A set of smooth steel sounds, shaped as ordinary catheters, enables the Surgeon to treat some strictures that are otherwise very troublesome to manage.

Modern Surgeons especially have contrived various instruments for the treatment of refractory strictures of the urethra on other principles than that of gradual dilatation. Amongst them are the urethrotomes of Fergusson, Thompson, Syme, Stafford, Wood, &c. for dividing portions of the urethra; and the dilators of Holt, Wakley, &c. for distending strictures. No doubt all these instruments, in careful hands, fulfil the purposes for which they were intended; but they are capable of doing much mischief, and require both the greatest skill and judgment in their employment.

For exploring the bladder in search of stone, &c., the Surgeon requires a set of steel sounds of various sizes and curves. They should be well polished, and have smooth handles; their extremities should be round and smooth. Then for incising the urethra a set of grooved staffs is essential. Some

Surgeons have them grooved at one side; others on their convex surface. Some use them of abrupt curves, some of gradual, and others straight. It is well to have an abrupt stop in the groove near the end of the staff, and the groove itself should be as deep as possible.

Some Surgeons employ the rectangular staffs of Buchanan and Hutchinson in lithotomy. The knives used by the great operators of our time are somewhat varied; but may be styled, in general terms, long-handled scalpels for cutting into the urethra, and beaked knives for incising the prostate. Many operators complete the incisions with one knife.

For the removal of stone from the bladder, forceps of many shapes and sizes are required to meet all the exigencies of practice. Probably few experienced Surgeons would be content with the choice of less than a dozen pairs; and occasionally nothing but the spoon-scoop will enable the operator to extract a stone or fragments of one; therefore one or two should be kept.

Sometimes a scoop curved laterally on its handle will prove a very convenient instrument for reaching a stone behind the prostate. This instrument is much recommended by Mr. H. Thompson.

The improved lithotrite of Messrs. Weiss and Son leaves little or nothing to be desired as a means for crushing a stone in the bladder. It is divested of the awkward handle of former instruments, and has in its place a short cylinder, which, being placed on the axis of the instrument, forms a convenient hold for the operator. It can be worked by means of its screw, or as a percussion lithotrite. The screw is fixed or disengaged in a moment by sliding a button along the cylinder, or simply by pressing it with the finger, without communicating any motion to the sliding portion of the instrument. The male blade is pushed home by turning the T on the end of the lithotrite. There can be no doubt that the motion of the screw is much better adapted for the purpose than that of the rack and pinion. The instrument has also the great advantage of being easily taken to pieces, cleaned, and re-adjusted; and such portions as are liable to rust are silver-plated.

Powerful lithotrites have been invented for breaking a stone which is too large to allow of its extraction by the wound made in the ordinary operation of lithotomy; but are seldom used or needed.

In addition to the instruments above enumerated, the Surgeon may require some means of removing a small calculus that has become impacted in the urethra. For this purpose a long slender straight forceps has been contrived. A forceps closed by means of a canula is also well adapted for the same purpose.

Eye instruments. These may be classed under two heads: 1st, instruments employed in diagnosis; 2d, operative instruments.

Under the first head must be mentioned that most essential instrument, the ophthalmoscope. Though very many forms of this instrument are employed by Surgeons, two or three only need be noticed here. For all ordinary purposes, the ophthalmoscopes of Liebreich, Coccious, and Zehender are recommended. They are very portable, of small cost, and of simple construction, and are, further, of easy application. With any one of these the eye may be effectively explored; but the two first named are more suitable for the indirect mode of examination, and the latter for the direct.

The large fixed instrument of Liebreich (fig. 7) is well adapted for class purposes, or for taking drawings. Small ophthalmoscopes that may be carried in the waistcoat-pocket are very convenient, and likely to be at hand when required. At the writer's suggestion, the mirror has been mounted as an ordinary pocket-lens, and occupies less space than a watch (fig. 8); and, being made of glass, it is less likely to become tarnished than metallic specula. The binocular ophthalmoscopes of Giraud-Teulon and Laurence afford beautiful views of the interior of the eye; and as the observer is enabled to use both his eyes at once, he sees with less light, and can minutely scrutinise the details of the stereoscopic image without sense of fatigue, and can judge more accurately of relief and depth than when using only one eye.

For side-illumination of the eyeball, two ordinary lenses, of about two-inches focus, are required. A good oil- or gas-lamp is also essential.

For the subjective examination of the eye, the Surgeon should have two sets of spherical lenses, of foci varying from 2 in. to 80 in.; one set being convex, the other concave. A series of cylindrical lenses is also required for the investigation of astigmatism; and also a stenopæic apparatus. For examining cases of paralysis of the muscles of the eye, a series of prisms should be provided.

Fig. 7.

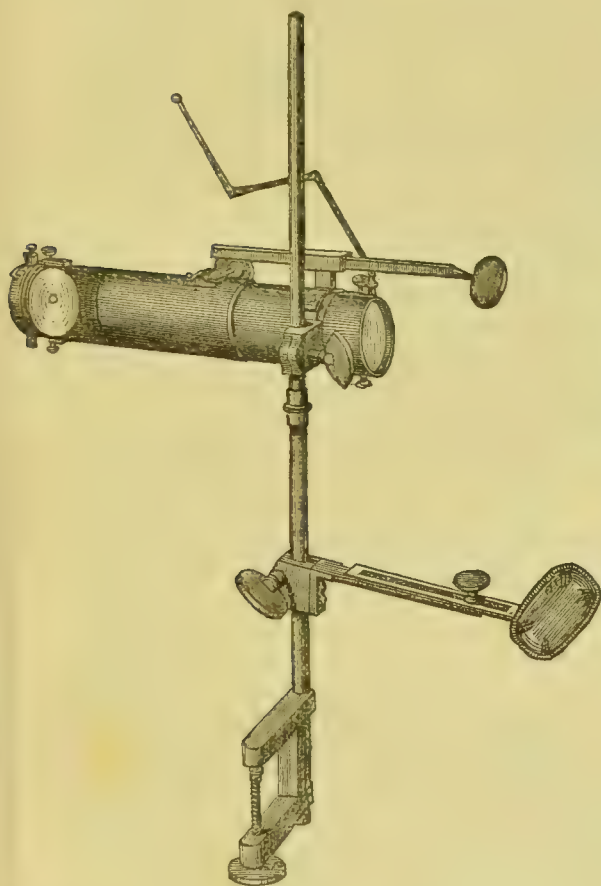
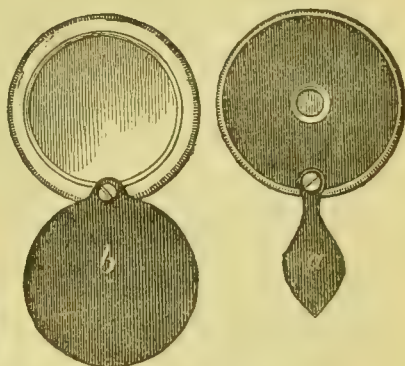


Fig. 8.



Then, as test-objects for ascertaining the acuteness of vision, and for future comparison, the scale of type invented by Snellen is an invaluable aid. It has been recently adopted by the Government as a standard.

The instruments required for the ordinary operations performed on the eye at the present date consist of the usual cataract-knife, or that of Beer modified by Sichel, &c.; the sharp hook for lacerating the lens-capsule; Daviel's spoon; a bistoury for enlarging sections of cornea, or scissors; Jäger's cornea-knives, straight and bent; iris-forceps and Tyrrell's blunt hook; curved iris-scissors, Schufft's spoons or Critchett's extractor, Luer's forceps and scissors, forceps for fixing the eye, strabismus-scissors and hook, cilia-forceps, needle-holder, suture-needles, entropium-forceps, spring-wire speculum for holding the eyelids, set of probes for lachrymal canals and nasal duct, director for opening the punctum, cautery-needle, broad cutting-needles, and two of Dalrymple's needles. The needles may be very conveniently fixed in two handles and slide as in a pencil-case. Tyrrell's iris-hook should be made of silver or platinum, so that it may be bent as required.

Many other instruments, adapted to special purposes, are used by ophthalmic Surgeons, which, though not absolutely indispensable, yet are of so frequent application that they deserve to be noticed in this enumeration of eye-instruments.

Such are the "stopped" needles of Bowman, which are provided with shoulders to prevent their passing too deeply into the eye, while both are being used at the same time,—as in lacerating a membrane which occludes the pupil; the canula-lancet of Bowman, for strictures of the lachrymal canals; Hulke's needle (set in a handle), for inserting sutures in the conjunctiva; Snellen's forceps for the eyelids, to restrain bleeding while operating for entropium, &c.; an ivory spatula, for raising the lids and protecting the eyeball while applying the actual cautery, &c.; Dixon's little spatula, to replace the iris when prolapsed; Desmarre's elevators, for the eyelids; Streatfeild's forceps, for fixing the eye; fine scissors, for enlarging the lachrymal punctum; White Cooper's curved forceps, for Luer's canula instrument; Critchett's bent cutting-needle, for making a small aperture in the cornea; the "suction-curette" of Mr. Teale jun., and those of Mr. Bowman and Dr. Bader, for the removal of cataracts of such consistence that they may be thus removed through a small aperture.

Almost all these instruments are delineated in the excellent illustrated Catalogue of Surgical Instruments lately published by Weiss, in the *Atlas chirurg. Instrumente und physikalischer Apparate für Aerzte*, von Jos. Leiter. Wien, 1863; and in Dr. Cessner's work, *Chirurgische Instrumenten*, Wien, 1863; to all of which the writers have been indebted for some of the descriptions of the instruments, as well as for the figures.

Fracture-apparatus. The appliances invented for the treatment of fractures of the bones are almost innumerable; so much so, that a bare enumeration of them would fill a goodly volume.

It would, therefore, be out of place to attempt to do justice to the different apparatus in these pages; but some are of such importance that some allusion must be made to them in a systematic work on Surgery; and though we cannot afford space to mention others, we are not insensible to their value.

Mr. Luke's fracture-bed is one of the most useful that has been contrived, and as it is not so well known as it deserves, we shall give a short description of it.

It consists of a light wooden bedstead, on which the mattress is placed, and of a frame to which a canvas-stretcher is fixed, having an aperture about its centre of about 8 or 10 inches diameter; on this the bedclothes are laid, and the stretcher lies between them and the mattress. The frame is attached to the bedstead by two iron bands on each side, so as to allow of a similar motion to that of the "parallel ruler." A curved iron arm, carrying a windlass and leather-band, slides into an aperture in the end of the bedstead, and when out of use, may be removed; to the free end of the strap is fixed a hook, and on the end of the frame an eye, to correspond when required for a patient. Two small blankets should be folded on the stretcher so as to allow of their being separated opposite the aperture in the canvas, and two sheets should be folded in the same way; the patient, being placed on them, may then be covered with the upper bedclothes as in an ordinary bed. To raise him while using the bedpan, the curved arm is to be fixed to the bottom of the bedstead, the strap hooked on the frame; and on turning the windlass he will be gently raised from the mattress, and may be retained in that position as long as necessary; the bedclothes are then separated over the aperture, and the bedpan placed under the stretcher. He may then be gradually lowered upon the mattress, the windlass removed, and the apparatus remains as an ordinary bed.

In cases of fracture or other injury of the spine, or of the femur, &c., this elevating bedstead is invaluable, as it avoids all necessity of moving from day to day.

Earle's or Amesbury's fracture-bed is provided with three inclined planes

for the patient's body, thighs, and legs, which are so arranged that the angles which they form with each other may be altered at pleasure, and therefore enable the Surgeon to flex the thighs on the pelvis, or the legs on the thighs, as he requires. The planes should also admit of lengthening or shortening, as a case may demand.

This bed is of much service in the treatment of fractures of the neck and upper portion of the shaft of the femur. Some Surgeons employ it also in fractures of the middle and lower thirds, and in fractures of the tibia and fibula attended with tilting of the ends of the bones.

Liston's thigh-splint is described at p. 615, vol. ii.

Skipton's splint is described at p. 629, vol. ii.

Lonsdale's apparatus for fracture of the patella is described at p. 624, vol. ii.

Salter's "sling" for fractures of the leg is described at p. 630, vol. ii.

The hydrostatic bed of Dr. Arnott is one of the most valuable inventions of modern times, and is almost indispensable in the treatment of patients long bedridden, and disposed to ulceration or mortification from continued pressure. It consists of an oblong trough partially filled with water, and covered with Macintosh cloth securely fixed to the top of the trough, but floating loosely on the surface of the water, so as to allow the patient to lie equably supported by partial displacement of the water.

The same purpose is attained in a less degree by means of mattresses or cushions made of impervious cloth, so as to contain water. But as the water-bed and mattress are very expensive, and unless treated with great care will be soon destroyed, they have been to a great extent superseded by bedsteads having spiral wire-springs to afford the desired elasticity, or bands with rings of caoutchouc attached to their extremities. The latter are very effective, and allow of easy adjustment by placing the bands and rings as required.

Spinal curvature. For the treatment of this deformity two kinds of apparatus may be employed: first, that which is intended to keep a weak spine straight, or to prevent an increase of curvature in its early stages; secondly, that which professes to press back displaced vertebræ by acting, by means of a pad, on the ribs.

The first is made by adding side steel crutches to the common French stay, which is laced up from behind, and closed in front by metal eylet-holes. These stays should be fitted to the patient very much too tight for ordinary use. Next, the Surgeon marks by a pencil the exact situation which the side steel crutch should occupy. By means of a long piece of lead he takes an exact impression of the form, and by such means the steel crutch can be moulded and fitted on within the stay on either side.

To this may be added a steel plate to press on the convexity of the curve, or numerous steels of small size to give strength where it is required. Such an apparatus, carefully made and constantly worn, will, with due care, prevent the sinking of the spine and the attendant visceral displacements.

The second variety of apparatus is intended to correct an established spinal curvature. Under all circumstances the principle is the same, being a modification of "Tavernier's belt." A padded steel belt goes round the pelvis; steel crutches extend thence on either side to the axillæ; a webbing-strap passes across the chest; and a pad, moved by a cogwheel, acts on the convexity of the curve. If there be two curves, two movable pads are requisite. Cogwheels are attached to the side crutches.

This is the apparatus of which it is said an almost daily attendance on the part of the Surgeon is necessary to effect a cure by means of cogwheels and screws.

If we divest the subject of charlatanism, we must confess that a patient, the subject of progressive curvature, may derive much benefit from carefully-applied and slowly-increasing pressure, such as may be obtained by the use of this instrument. When once the vertebræ have become altered in shape and thinned towards the concavity of the curve, no complete cure can be

effected. But in a very great number of cases the patient's condition may be greatly ameliorated.

Nearly every practitioner of this branch of the profession has affixed his name to some apparatus or another ; they are in most points similar.

The treatment by slow extension and by direct pressure of deformities, caused by the contraction of large cicatrices after burns, or other causes of extensive destruction of the integument, is a subject meriting attention. The apparatus used to straighten a contracted limb is similar to that already described as applicable to cases of contraction after disease of the articulation ; that employed to stretch the contracted integument of the neck is a variety of the spinal apparatus with a movable piece of padded steel, worked with a screw, and passing round the head. The principle is in all instances the same,—the very slow and gentle application of the extending power. If the skin cracks, the apparatus must be removed until the wound is closed ; and during the period of healing, the parts inevitably become recontracted. After a sufficiently protracted course of treatment, the extended cicatrix loses its disposition to gather up in puckered folds.

Direct pressure is also useful in certain cases : it renders a hardened cicatrix soft and pliant. It may be effected by the use of metal plates, of leather, or of gutta-percha bound carefully on the affected part.

All such methods are preferable to the use of the knife.

The extension of limbs contracted after disease of joints is effected by a well-padded apparatus worked by a cogwheel. All the plates of metal surrounding the limb should be broad, that the pressure may not cut into the flesh. If the patient is able to move about, a boot may be attached to the irons. If he be confined to bed, a thin slipper with a metal sole is more appropriate. The movements at the joint should resemble the natural movements of the limb : thus, at the elbow and the knee, the simple movement of extension and flexion will suffice ; while at the hip there will be needed the movements of flexion and extension, abduction and adduction ; also rotation. For each of these a special screw is requisite ; and the whole apparatus must be attached to the body by a pelvic band.

HOLMES COOTE.

JOHN C. WORDSWORTH.

INDEX.

[The words in capital letters are the titles of essays; when no number of volume precedes the number of the page, the matter will be found in the volume last referred to.]

- ABDOMEN**, abscess of, i. 152, ii. 402, iv. 148; burns of, i. 729; contusion of, ii. 388; foreign bodies in, 472; gunshot wounds of, 65; **INJURIES OF**, 388; paracentesis of, iv. 181; rupture of viscera of, ii. 409; tumours of, iv. 973; wounds of, nonpenetrating, ii. 427; penetrating, 431.
- Abdominal aneurism**, iii. 515; aorta, ligation of, 518; hernia, see *Hernia*; muscles, rupture of, ii. 399; viscera, rupture of, 409, wounds of, 449.
- ABSCCESS**, i. 141; acute, 145; alveolar, iv. 2; chronic, i. 159; cold, 160; fecal, iv. 149; lacunar, 635; mammary, 670; pelvic, i. 153; perinephritic, iv. 333; psoas, iii. 845; puerperal, i. 154; pyæmic or secondary, 277; retropharyngeal, 158; scrofulous, 340; urinary, iv. 410; after contusion, i. 575; leading to aneurism, iii. 351; near joints, i. 151; of abdomen, 152, iv. 148, from injury, ii. 402; of antrum, iv. 25; of axilla, iv. 969; of bladder, iii. 348; of bone, 630; of brain from injury, ii. 185; of breast, i. 155, iv. 670; of forearm, ii. 520; of hand, i. 160, ii. 519; of joints, iii. 709; of kidney, iv. 333; of labium, 652; of meatus auditorius, iii. 141; of neck, i. 148, iv. 965; of orbit, 155, ii. 886; of parotid, iv. 960; of perineum, i. 157, iv. 410; of popliteal space, iv. 981; of prostate, 363; of septum nasi, iii. 200; of spine, 840; of testis, iv. 576; of tongue, iii. 902; of tonsil, i. 158.
- Abscess-knife**, iv. 1040.
- ABSORBENT SYSTEM, DISEASES OF**, iii. 259.
- Absorbents**. See *Lymphatics*.
- Absorption**, i. 389; of pus, 141; of tubercle, 339; 'physiological' of Hunter, iv. 629; of water from the lungs, 877.
- Acarus folliculorum**, iv. 748; scabiei, 732.
- Acephalocyst**, iv. 908, and see *Hydatid*.
- Acetabulum**, affection of in hip-disease, iii. 780.
- Achores**, iv. 712.
- Acne**, iv. 747; rosacea, 748; sebacea, 749.
- Acritochromacy**, ii. 863.
- Acromio-clavicular joint**, dislocations of, ii. 562; diseases of, iii. 790.
- Acromion**, fracture of, ii. 533.
- Acupressure** in hæmorrhage, iv. 1038.
- Acupuncture**, iii. 23; in ununited fracture, i. 802.
- Acute abscess**, i. 145; tetanus, 300.
- Addison's disease**, iv. 759.
- Additamentary bones**, iii. 725, 738.
- Adenitis**, iii. 267.
- Adenocoele**, iv. 677; groups or classification of, 677; cysts in, their nature, 677; recurrence of, 679; synonyms of, 677.
- Adhesion**, primary, i. 584; secondary, 587.
- Adhesions in hernial sac**, iv. 281; in ovariectomy, 529.
- Adhesive inflammation**, syphilitic, i. 400; union by, 584.
- Administration of hospitals**, iv. 1005.
- Agalactia**, iv. 676.
- Age at which cancer of breast commences**, iv. 688; effect of, on mortality of lithotomy, 462; effect of, on occurrence of stone, 442; in reference to diagnosis, 929.
- Air in veins**, i. 696.
- Air-passages**. See *Bronchi, Larynx, Trachea*.
- Albinism**, iv. 760.
- Albino**, peculiarities of the eye in the, ii. 733.
- Albugo**, ii. 719.
- Albuminuria in diphtheria**, iv. 64; in relation to lithotomy, 447; to operations in general, 938.
- Alcohol-poisoning**, iv. 887.
- Allarton's operation of median lithotomy**, iv. 466; statistics of, 470.
- Alopecia**, iv. 730; syphilitic, i. 442.
- Alternating calculus**, iv. 433.
- Alveolar abscess**, iv. 2; cancer, see *Colloid*.
- Amaurosis**, ii. 772; reflex, iii. 885; following injuries of nerves of face, i. 249; from disease of teeth, &c. iv. 27.
- Amazia**, iv. 654.
- Amesbury's fracture-bed**, ii. 617.
- Ammoniæ liquor**, as a vesicant, iii. 20.
- AMPUTATION**, iii. 51; circular and flap, 56; modified circular, 59; rectangular flap, 60; in fracture, i. 782; in gangrene, 183, iii. 339; in gunshot wound, ii. 84; primary, in lower extremity, 655, 658; primary, in upper extremity, 522; dressing after, iii. 65; instruments for, 70; of various members,

- see under those heads, as *Finger, Hip, Thigh*.
- Amputating knives, iv. 1042.
- Amussat's operation, iv. 180.
- Anæmia exciting ulceration, i. 65.
- Anæsthesia, iii. 100; reflex, 835.
- ANÆSTHETICS, iii. 91; in military surgery, ii. 91.
- Anæsthesia, local, iii. 92.
- Anastomosing vessels, enlargement of, after ligature or obstruction of artery, iii. 397.
- Anel's operation for aneurism, iii. 393, 5.
- ANEURISM, iii. 343; arterio-venous, 447; bursting of, 355; by anastomosis, 454; cirroid, 454; clots in, 359; consecutive, 347; diffused, 347; dissecting, 461; false and true, 346; fusiform, 344; hernial, 347; secondary, on ligature of artery, i. 677; traumatic, iii. 438; after fractured skull, ii. 127; varicose, iii. 447; recurrence of, 407; spontaneous cure of, 362; without pulsation, 358; symptoms and diagnosis of, 378; treatment of, by the old operation, 385; by ligature, 389; by compression, instrumental, 413; digital, 421; by flexion, 425; by manipulation, 428; by galvano-puncture, 432; by injections, 435; of individual arteries, see the names of them, as *Aorta*.
- Aneurismal diathesis, iii. 348; dilatation, 344; varix, 447.
- Angeioleucitis, iii. 260.
- Angular curvature of the spine, iii. 833, 8.
- ANIMAL POISONS, i. 618.
- Animals, diseased, wounds from, i. 625; healthy, wounds from, 622.
- Animation, suspended. See *Apnœa*.
- Ankle, amputation at, iii. 82; diseases of, 788; dislocations of, ii. 655; compound, 658; excision of, iii. 824; fractures into, ii. 633, 656; gunshot wound of, 84; sprains of, 591.
- Ankylosis, false, iii. 766; from dislocation, i. 816; from fracture, 782; osseous or true, iii. 770; deformities from, 600; tenotomy for, 769; of hip, 605, 609; of knee, 605, 608; of spine, 843; of stapes, 178.
- Annuloida, parasitic, iv. 904.
- Antescrotal urinary fistulæ, iv. 415.
- Anthrax. See *Carbuncle*.
- Antiphlogistics, i. 105; caution as to, 126.
- Antiseptics, i. 182.
- Antrum, abscess of, iv. 25; foreign bodies in, ii. 256, iv. 31; variable extent of, 25.
- Antyllus, operation of, for aneurism, iii. 385.
- Anus, artificial, ii. 453; iv. 252; the éperon in, ii. 461; operations for formation of, see *Colotomy*; fistula of, iv. 199; fissure of, 210; imperforate, 812; pruritus of, 224; ulcer of, 206.
- Aorta, abdominal, aneurism of, iii. 515; compression of, 90, 516; ligature of, 518; thoracic, aneurism of, 480.
- Aphonia, hysterical, iii. 240.
- Aphthous ulceration of mouth, iv. 108.
- APNŒA, iv. 872; causes of, 878; experiments on, 879; mode of death in, 886; physiology and pathology of, 877; post-mortem appearances, 874; symptoms of, 873; treatment of, 891; rules for treatment, 900; treatment by bleeding, 898; secondary apnœa, 889.
- Apoplexy, resemblance of its symptoms to those of traumatic compression, ii. 112.
- Arachnida, iv. 918, 921.
- Arachnoid membrane, traumatic extravasation in, ii. 109; inflammation of, see *Meningitis, cerebral*.
- Arcus senilis, ii. 707.
- Areola of breast, anatomy of, iv. 656; diseases of, 694.
- Areolar tissue, affections of, near diseased joints, iii. 764.
- Arm, see *Extremity, upper*; amputation of, iii. 77.
- Arnott's bed, iv. 1051.
- Arterial hæmorrhage, i. 682; varix, iii. 454.
- ARTERIES, DISEASES OF, iii. 323; INJURIES OF, i. 666; atheroma of, iii. 323; contusion of, i. 669; displacement of, by tumour or abscess, iv. 982; embolism of, iii. 333; gunshot wounds of, ii. 31; inflammation of, iii. 342; laceration of external coats of, i. 680; of inner coats of, 672; ligature of (general pathology of), 674; (for ligature or injury of special arteries, see their names, as *Femoral*;) obstruction of, as cause of inflammation, i. 65, of gangrene, iii. 331; occlusion of, 332; in childbirth, 333; in rheumatic fever, 333; ossification of, 324; rupture of, 330; wounds (penetrating), i. 681.
- Arteriotomy, iii. 35.
- Arterio-venous aneurism, iii. 447.
- Arteritis. See *Arteries, inflammation of*.
- Artery-forceps, iv. 1038.
- Arthritis, chronic rheumatic, iii. 723.
- Arthritic iritis, ii. 749; ring, 747.
- Articular ends of bones, diseases of, iii. 740.
- Artificial anus, ii. 453, iv. 254; membrana tympani, iii. 158; pupil, ii. 753; by excision, 756; by incision, 755; by laceration, 755; by ligature, 760; respiration, iv. 892; in accidents from anæsthetics, iii. 105; in infants, iv. 897.
- Asphyxia. See *Apnœa*.
- Astragalus, dislocation of, ii. 666; fracture of, 634.
- Atheroma, iii. 323.

Atlas, disease of, iii. 866; fracture of, ii. 215; necrosis of, iii. 871.

Atony of bladder, iv. 356.

Atrophy of bone, iii. 699; of breast, iv. 667; of glands, iii. 269; of prostate, iv. 377; of testis, 609; of veins, iii. 307; reflex, 890.

Atropine, use of, in iritis, ii. 750.

Attached foetus, iv. 802.

Auditory nerve, affections of, iii. 181; 181; injuries of, ii. 177.

Aura hysterica, i. 370.

Auricles supernumerary, iii. 135; tumours of, 136. See also *Ear, external*.

Axilla, abscess of, iv. 969; aneurism in, iii. 470; cancer in, 518; enlarged glands, removal of, iv. 970; exostoses in, 970; regional surgery of, 969; tumours of, 969; their removal, 971.

Axillary artery, injuries of, iii. 471, 475; ligature of, 473; glands, enlargement of, iv. 970.

Axis, disease of, iii. 866; fracture of, ii. 215.

BACK, INJURIES OF THE, ii. 197; sprains of, 198.

Balanitis, iv. 638.

Bandages, iii. 1; compound, 6; figure-of-8, 3; four-tailed, 7; immovable, 9; many-tailed, 8; simple, 1; spiral, 1; suspensory, 7; T, 6.

Bar at neck of bladder, iv. 353.

Barbadoes leg, iv. 755.

Bar-shot calculi, iv. 431.

Base of the skull, fracture of, ii. 121.

Beaked sound, iv. 372.

Bed-sores after fractured spine, ii. 217.

Beer's knife, ii. 824.

Bees, stings of, iv. 923.

Bending of bones, i. 762.

Bibliography of inflammation, i. 132.

Biceps cubiti, contraction of, iii. 587.

Biceps femoris, rupture of, iii. 523.

Bilateral lithotomy, iv. 466.

Bilharzia hæmatobia, iv. 912.

Biliary fistula, congenital, iv. 818.

Birth, distortions originating during, iii. 580.

Bistouries, iv. 1038.

Bites of animals, i. 622.

Bladder, abscess of, iv. 348; atony from distension, 356; bar at neck of, 353; bursting of, from accumulated secretion, ii. 486; cancer of, iv. 351; calculus of, 444, in female, 475; catarrh of, 345; disease of, from fractured spine, ii. 222; engorgement and overflow, iv. 360; exstrophy, 339; fistula of, 348; foreign bodies in, ii. 486; gunshot wound of, 68; hæmorrhage from (hæmaturia), iv. 335; hernia of, 354; hypertrophy and sacculation, 349; inflammation, acute, 341; chronic, 343; injuries of, ii. 479; inversion

of, iv. 354; irritability of, 357. *Malformations*, viz. absence of, 338; exstrophy, 339; multiple, 338. Paralysis of, 355; perverted sensibility or neuralgia of, 358; protrusion of, from wound, 439; puncture of, per rectum, 418; above the pubes, 419; through the symphysis, 419; rupture of, ii. 480, iv. 422; spasm of, 357; supuration of, 348; tubercle of, 353; tumours, fibrous, 350; villous, 351; cancerous, 351; ulceration of, 348; wound of, ii. 485.

Bleeding. See *Bloodletting*, *Hæmorrhage*.

Blenorrhagia, iv. 626; syphilitic, 627.

Blenorrhœa, iv. 636.

Blisters, iii. 19; in ununited fracture, i. 799.

Blood, extravasation of, in injuries of the abdomen, ii. 400; in injuries of the head, 104, 145; heat of, in inflammation, i. 43 note; in inflammation, 53; in pyæmia, 269; entrance of water into, in drowning, iv. 881; morbid conditions of, as cause of inflammation, i. 63; post-mortem condition of, in apnœa, iv. 875. See also *Hæmorrhage*.

Blood-calculus, iv. 441; clots, organisation of, i. 575.

Blood-cyst of groin, iv. 978; of popliteal space, 980.

Bloodletting, iii. 29; as antiphlogistic, i. 105; in apnœa, iv. 898; in gunshot wounds of chest, ii. 60.

Blood-tumour, see *Hæmatoma*; of scalp, iv. 948.

Blood-vessels in inflammation, i. 16. See also *Arteries*, *Veins*.

Blows. See *Contusions*.

Boil, iv. 774; blind, 775.

BONES, DISEASES OF, iii. 615; absorption of, 649; atrophy of, 699; bending of, i. 762; cancer of, iii. 673; chronic abscess of, 630; cysts of, 695; death or gangrene of (necrosis), 640; hydatids in, 697; hypertrophy, iv. 699; inflammation, iii. 615; mollities, 667; osteomyelitis, 628; periostitis, 622; rheumatic and gouty affections of, 665; sinuses in, i. 167; scrofulous affections of, iii. 656; syphilitic disease of, 660, i. 443; tubercle in, 657; tumours of, iii. 685; ulceration of carious, 633; phagedænic, 639; cancerous, 684; wounds of, 702; of lower limb, contusion of, ii. 589.

Bony ankylosis, iii. 770.

Bony growths, see *Exostosis*; in breast, iv. 684.

Bougies, use of, in gonorrhœa, iv. 648. Boutonnière palatine, iii. 217; urethral, see *Perineal section*.

Bowel. See *Intestine*.

- Bowman's canula-lancet, iv. 1050; operation for lachrymal obstruction, ii. 869; stopped needle for operating on opaque capsule, iv. 1050.
- Brachial artery, ligature of, iii. 469.
- Brain, compression of, ii. 107; concussion of, 141; contusion of, 152; extravasation in, 112; protrusion of (hernia), ii. 163; implicated in diseases of the ear, iii. 185; state of, after death from apnoea, iv. 875.
- Brasador's operation for aneurism, iii. 485.
- BREAST, FEMALE, DISEASES OF, iv. 653; abnormal secretion, 675; abscess of, 670; adenocoele, 677, and see *Adenocoele*; amputation of, 665; anatomy, surgical, of, 653; of nerves of, 659; atrophy, 667; bony or osteoid growths in, 684; cancer, 686; its varieties, tuberosus and cystiform, 687; age of its development, 688; treatment, 691; ulceration of, 692; chronic induration of, 673; colloid tumour, 685; contusion, effects of, 675; diagnostication of diseases of, 660; duct-cysts, 680; enchondroma, 684; fibro-plastic growths, 685; galactocoele, 682; hydatids, 685; hyperæsthesia, 675; hypertrophy, 666; hysterical disease, i. 365; inflammation, iv. 668; lipoma, 683. *Malformations*, viz. absence, 654; plurality, 654; imperfection of ducts, 659. Neuroma, 684; sero-cysts, 682; strapping the, 665; treatment, general principles of, 663; vascular growths, 684; nipple and areola, diseases of, 693.
- Breast, male, diseases of, iv. 694.
- Bronchi, foreign bodies in, ii. 306.
- Bronchocele, simple, iv. 697; endemic (goitre), 697; assigned causes of, 698; geographical distribution of, 698; treatment by ligature of arteries, 699; by setons, 700; by strychnia, 700; by tracheotomy, 701; pulsating or exophthalmic, 702.
- Bronchotomy. See *Laryngotomy*, *Tracheotomy*.
- Bronzed skin, iv. 759.
- Bruise. See *Contusion*.
- Bruit, aneurismal, iii. 378; in arterio-venous aneurism, 449.
- Bubo, gonorrhoeal, iv. 639, 652; syphilitic, indolent, i. 412; suppurating, 451; bubon d'emblée, iv. 629.
- Buchanan's method of lithotomy with rectangular staff, iv. 466.
- Buffy coat, i. 53.
- Bullæ, iv. 711, 733.
- Bullets, lodgment of, ii. 13; extraction of, 37.
- Bunion, iii. 551, iv. 766.
- BURNS, i. 723; amputation in, 748; applications in, 744; classification of, 723; contracted cicatrix from, iii. 130; periods of, i. 730; statistics of, 733; from lightning, 751; of larynx, ii. 288; ulceration of intestine in, 741.
- Bursa patellæ, enlargement of, iii. 548; abscess of, 549; loose bodies in, 549; tumour of, 550.
- Bursæ, diseases of, iii. 548; enlarged, of neck, iv. 966; of popliteal space, 979.
- Butcher's saw, iii. 802, iv. 1042.
- Calcaneum, dislocation of, ii. 669; fracture of, 635; excision of, iii. 827.
- Calcareous tubercle, i. 340.
- Calculus nephralgia, iv. 330; pyelitis, iv. 331.
- Calculus, nasal, iii. 196; prostatic, iv. 380; of veins (phlebolithes), iii. 305; renal, iv. 330; URINARY, iv. 424; age at which it occurs, 442; alternating, 433; animal portion of, 430; classification, 429; composition of uric acid, 435; urate of ammonia, 436; uric or xanthic oxide, 436; oxalate of lime, 436; cystic oxide, 438; phosphate of lime, 439; triple phosphate, 439; fusible phosphates, 440; carbonate of lime, 440; fibrinous, 441; uro-stealith, 441; blood, 441; formation of, 429; physical characters of, 431; section of, 432; tests for, 434; in bladder, 444; symptoms of, 445; sounding for, 447; mode of death in, 449; solution of, 451; operations for, see *Lithotomy* and *Lithotripsy*; recurrence of, iv. 463; in female bladder, 475; operations for, 476; in prostate, 472; vesico-prostatic, 473; in scrotum, 620; in urethra, 474; extraction of, 475; in urethral fistula, 414.
- Callisen's operation, iv. 180.
- Callous ulcer, i. 217.
- Callus, provisional, i. 787; permanent, 788.
- Calvarium. See *Skull*.
- CANCER, i. 508; dissemination of, 543; mode of death in, 537; nature of, 538; origin of, 541; varieties of, 510, viz. scirrhus, 511; encephaloid or medullary, 523; epithelial, 529; osteoid, 533; colloid, 534; villous, 536; of various organs and systems, see under their names, e.g. *Cicatrices*, *Glands*, *Eye*, *Testicle*.
- Cancer-cells, i. 521, 527, 530; in urine, iv. 379.
- Cancerous ulcer, i. 212, 516.
- Canceroid, i. 529; ulcer, i. 210.
- Cancerum oris, i. 177.
- Cannon-balls, wounds from, ii. 23.
- Cantharides, use of, iii. 19.
- Capillaries in inflammation, i. 20.
- Capsular cataract, ii. 795.
- Capsule opaque, operations on, ii. 843.
- Carbonate of lime, deposit of, in urine, iv. 428; calculus, 440.

- Carbonic acid, death from respiring, iv. 885.
- Carbuncle, i. 3; iv. 781; causes of, 782; treatment by incision, 784; caustic, 784; pressure, 785; facial or malignant, 786.
- Carcinoma. See *Cancer*.
- Caries, iii. 633; of the spine, 831.
- Carotid arteries, ligature of, iii. 488, 495, 498; aneurism of internal, 493; division of in operation, iv. 968.
- Carpus, fracture of, ii. 556; dislocation, 585; excision, see *Wrist*.
- Carron oil, i. 746.
- Cartilage, articular, deposits in, iii. 755; diseases of, 752; fatty degeneration, 755; hypertrophy, 755; ulceration, i. 32, iii. 757; costal, fracture of, ii. 347; wound of, 352; interarticular, of knee, subluxation of, 653; laryngeal, fracture of, ii. 285; necrosis of, iii. 249; ossification of, 756; loose, in joints, 725, 736.
- Cartilaginous tumour. See *Enchondroma*.
- Castration, iv. 601; in erotomania, 606.
- Cataract, ii. 794; black, 803; capsular, 795; congenital, 799; cortical and nuclear, 795-7; fluid, 804; hard, 796; pyramidal, 800; soft, 796; traumatic, 805; operations for, 809.
- Cataract-knives, iv. 1049.
- Catarrh of the bladder, iv. 345.
- Catarrhal ophthalmia, ii. 676; affection of meatus auditorius, iii. 144.
- Catheter, Eustachian, iii. 163; female, iv. 1039; ordinary, 391; prostatic, 371.
- Catheterisation, iv. 391; forced, 418; in the female, 1040.
- Cause alleged of disease, in reference to diagnosis, iv. 932.
- Caustic case, iv. 1040.
- Caustics, iii. 39; in cancer, i. 565; in carbuncle, iv. 784; in spermatorrhoea, 605; in stricture, 400.
- Cauterisation en flèches, iii. 43.
- Cautery, iii. 28; galvanic, 44; in ununited fracture, i. 805.
- Cells in cancer, i. 521, 526; in inflammation, 30; in pus, 141.
- Cellular products in inflammation, i. 29.
- Cellulitis, diffuse, i. 237.
- Centipedes, and their bites, iv. 921.
- Cephalæmatoma, iv. 949; subaponeurotic, 948.
- Cercaria, iv. 910.
- Cercomonas, iv. 903.
- Cerebellum, contusion of, ii. 155.
- Cerebrum, contusion of, ii. 155. See also *Brain*.
- Cerumen, accumulation of, iii. 138.
- Cervical fascia, importance of its relations, iv. 961.
- Cervical glands, enlargement of, iv. 964; syphilitic, 964.
- Cervical vertebrae, fracture of, ii. 212; disease of, iii. 854, 866.
- Cervix uteri, excision of, iv. 508.
- Chancre, Hunterian, i. 400; sloughing and phagedænic, 457; suppurating, 446; ulcerating, 450; of lip, iv. 410; urethral or larvæ, 627.
- Charbon. See *Malignant Pustule*.
- Charcoal, use of, i. 114.
- Cheek, adhesion of, to gum, ii. 258; cysts of, iv. 957; nævus of, 108; tumours of, 957.
- Cheiloplasty, iii. 121.
- Cheloid. See *Keloid*.
- Chemistry, its province in diagnosis, iv. 943.
- Chemosis, ii. 673, 680, 3, 6; after extraction of cataract, 834.
- CHEST, INJURIES OF, ii. 340; burns of, i. 729; figure of, in lateral curvature, iv. 844; foreign bodies in, ii. 366; gunshot injuries of, 55; paracentesis of, 369; pigeon-breast deformity of, iv. 859; wounds of non-penetrating, ii. 350; penetrating, 353.
- Chigoe, iv. 918.
- Chilblain, iv. 792; diurnal exacerbations of, 793.
- Childbirth, occlusion of arteries after, iii. 333.
- CHILDHOOD, SURGICAL DISEASES OF, iv. 799; aneurism in, iii. 349; gangrene in, iv. 838; injuries in, 828; leucorrhœa in, 839; operations in, 799; paralysis of, 835; secondary surgical affections in, 799; sore-throat in, 80; syphilis in, 829; tumours in, 828; tumours of vagina in, 840.
- Chimney-sweeper's cancer, iv. 621.
- Chionyphe Carteri, iv. 920.
- Clitoris, enlargement of, iv. 511; epithelioma of, 510.
- Cloaca, iii. 643.
- Chloasma, iv. 731.
- Chloroform, iii. 91; as a vesicant, 20; death from, 94, iv. 885; effect of, in abolishing muscular contractility, 889; narcotic effects of, iii. 92; in childhood, iv. 801; in collapse, i. 721; in diagnosis of hysteria, 367; in gunshot wounds, ii. 91; in hernia, iv. 265; in lithotrity, 486; in ophthalmic surgery, ii. 894.
- Chopart's amputation, iii. 82.
- Chordee, iv. 635.
- Chorea reflex, iii. 883.
- Choroid, affections of, ii. 768; ophthalmoscopic appearances of, in health, 779; in disease, 784.
- Choroiditis, ii. 768.
- Chronic abscess, i. 159; mammary tumour, see *Adenocoele*; ophthalmia, ii. 699; rheumatic arthritis, iii. 723; ulcer, i. 217.
- Cicatrization of burns, i. 747.

- Cicatrix, structure of, iii. 111; bleeding, i. 654; cancerous, 516; contracted, 613; treatment of, iii. 130; defective, i. 611; diseases of, 611; excessive, 612; growth of, 148; keloid growth of, 614; painful, 611; permanence of, 147; tumours of, 616; ulceration of, 616; of brain after injury, ii. 162; of face, 257; of neck, iii. 131.
- Circular amputation, iii. 57.
- Circulation, changes in, in inflammation, i. 16; collateral after ligature, 679; phenomena of, in reference to diagnosis, iv. 937.
- Circumcision, iv. 624, 641.
- Cirroid aneurism, iii. 454.
- Cirsocele. See *Varicocele*.
- Civiale's method of lithotrity, iv. 481; urethrotome, 403.
- Clam, adhesion, iv. 529.
- Clamp for ovariectomy, iv. 531.
- Clavicle, dislocation of, ii. 559; fracture of, 526; compound, 529; incomplete, 529; of acromial end, 528; of sternal end, 528; excision of, iii. 807.
- Cleft palate, iv. 88.
- Cloth, &c., impacted in gunshot wounds, ii. 17.
- Clots, aneurismal, iii. 359; formation of, in vessels, i. 274, iii. 291, 333; softening of, i. 289.
- Clovehitch, ii. 586.
- Club-foot, iii. 562; relapsed, 574; apparatus for, 573.
- Club-hand, iii. 587.
- Coagulation of blood in inflammation, i. 53.
- Coagulum. See *Clot*.
- Cobra di capello, iv. 925; bite of, i. 624.
- Coccyx, dislocation and fracture of, ii. 479.
- Cold, as anæsthetic, iii. 92; as antiphlogistic, i. 97; treatment of cancer by, 568; producing inflammation, 75; abscess, 160; ulcer, 201; water-cure, 111.
- COLLAPSE, i. 705; chloroform in, 721; primary operations in, 721.
- Collateral circulation after ligature, i. 679, iii. 397.
- Colloid tumour, i. 534; of breast, iv. 685.
- Coloboma, ii. 253; iridis, 732.
- Colour-blindness, ii. 863.
- Colotomy, iv. 176; in imperforate rectum, 816.
- Colubrine snakes, characters of, iv. 925.
- Combustion, spontaneous, i. 728.
- Comminuted fracture, i. 760.
- Complete fistula, i. 166, iv. 200.
- Compound cysts, i. 468.
- Compound dislocation, 824; of ankle, ii. 658; of elbow, 522, 582; of knee, 654; of phalanges of hand, 524; of shoulder, 579.
- Compound fracture, i. 757, 778, 789, 791; of special parts, see their names.
- Compression of brain, ii. 107.
- Compression-treatment of aneurism, iii. 413; by digital pressure, 421.
- Compression, digital, in amputation, ii. 73.
- Concussion of the brain, ii. 141; of spinal cord, 239.
- Condy's solution, i. 747.
- Condylomata. See *Mucous tubercle*; *Warts, venereal*.
- Congelation. See *Cold*.
- Congenital cutaneous cysts, i. 472; dislocation, iv. 822; of the hip, 822; fracture, 826; hydrocele, 550; hypertrophy of gum, 18; inguinal hernia, 234, 292, 295; phimosis, 640; rickets, 826, 842; sacral tumour, 805; syphilis, ii. 746, iv. 829; diagnosis of, 833; treatment of, 834.
- Congestion, i. 35; in burns, 735.
- Conical bullets, their effects, ii. 6; cornea, 705.
- Conjunctiva, granular, ii. 688; injection of, 673; injuries of, 700.
- Conjunctivitis, i. 69; and see *Ophthalmia*.
- Consecutive aneurism, iii. 347.
- Conservative surgery. See *Excisions*.
- Constipation, as cause of obstruction, iv. 166; from blow on abdomen, ii. 396.
- Contagion, as cause of inflammation, i. 68.
- Contre-coup, ii. 158.
- Contused wound, i. 597.
- Contusion, i. 570; as cause of inflammation, 57; disease after, 576; induction after, 575; paralysis after, 576; persistence of pain after, 576; of abdomen, ii. 388; of arteries, i. 669; of brain, ii. 152; diffused, 157; of breast, sequelæ of, iv. 675; of cornea, ii. 721; of face, 246; of larynx, 282; of lower extremity, 588; of pelvis, 474; of thorax, 341, 350.
- Convalescent hospitals, iv. 1034.
- Convulsions from injury of head, ii. 160; in disease of tympanum, iii. 172; rotatory, 883.
- Copaiba and cubebs in gonorrhœa, iv. 646; in rash, 647.
- Coracoid process, fracture of, ii. 534.
- Cord. See *Spermatie, Spinal*.
- Cornea, diseases of, ii. 705; conical, 705; contusion, 721; fistulæ after extraction of lens, 837; inflammation, i. 32, ii. 708; injuries of, 720; opacities of, 689, 718; ulcers of, 716.
- Corns, iv. 762; fibrous, 764; soft, 764.
- Coronoid process of ulna, fracture of ii. 546.
- Corrigan's hammer, iii. 20.
- Coryza, chronic, iii. 203.

- Costal cartilages, fracture of, ii. 347; wound of, 352.
- Counter-irritants, i. 101, iii. 17.
- Course of disease, in reference to diagnosis, iv. 933.
- Coxalgia. See *Hip*.
- Cracks of lip, iv. 106; of nipple, 693; of tongue, iii. 902.
- Cranium, disease of, after scalp-wound, ii. 98; fracture of, 113; pus beneath after injury, 100; proportions of, to face, iv. 854. See also *Skull*.
- Crepitation or crepitus, i. 766; considered in reference to diagnosis, iv. 941.
- CROUP, iv. 72.
- Crura cerebri, contusion of, ii. 154.
- Crural. See *Femoral*.
- Cuneiform bones, dislocation of, ii. 670.
- Cubic space in hospitals, iv. 1008.
- Cupping, iii. 31.
- Curette, ii. 826; suction, iv. 1050.
- Curvature of the spine, angular, iii. 833, 838; lateral, iv. 844; general appearances in, 844; causes of, 847; mechanism of, 848; diagnosis of, 852; prognosis of, 856; rickets, 852.
- Cutaneous or dermoid cysts, i. 472.
- Cut-throat, ii. 270.
- Cynanche, iv. 77.
- Cysticercus cellulosæ, iv. 905; under conjunctiva, ii. 703; in anterior chamber of eye, 726, iv. 907; in vitreous chamber of eye, ii. 791, iv. 907; in muscles, 907.
- Cystic disease of testicle, iv. 587; tumour of neck, 962.
- Cystic oxide calculus, iv. 438; deposit in urine, 427.
- Cystitis, acute, iv. 341; chronic, 343.
- Cystocele, iv. 233, 354.
- Cysts, i. 464; colloid, 468; compound, 468; congenital cutaneous, 472; dentigerous, iv. 32; dermoid, 599; mucous, i. 467; oily, 468; proliferous, 469, iv. 677; sanguineous, i. 467; serous, 464; of breast, iv. 682; of bone, iii. 495; of broad ligament, iv. 519; of breast, 682; of breast-ducts, 680; of cheek, 957; of eyelids, ii. 880; of jaws, iv. 120; of neck, 962; of ovary, 520; of popliteal space, 979; of testis, encysted hydrocele, 557, dermoid cysts, 599; of vulva, 511; in adenocele, 677.
- Cyst-worms of tæniada, iv. 905.
- Daercyocystitis, ii. 867.
- Daerylolithes, ii. 872.
- Daeryops, ii. 872.
- Dactylius aculeatus, iv. 918.
- Daviel's spoon, iv. 1049.
- Deafness, iii. 182; syphilitic, 185.
- Deformities, iii. 557; congenital, 110.
- Degrees (six) of burn, i. 723.
- DELIRIUM TREMENS, i. 323; reflex, iii. 888.
- Demarcation, line of, i. 179.
- Demodex folliculorum, iv. 748.
- Dentigerous cysts, iv. 32.
- Depilation from lightning, i. 750.
- Deposits, secondary, i. 276.
- Depression of cataract, ii. 809.
- Derivatives, i. 104.
- Dermoid cysts, i. 472; of ovary, iv. 521; of testis, 599.
- Desault's splint, ii. 615.
- Descendens noni nerve, division of, in operation, iv. 968.
- Determination of blood in inflammation, i. 19.
- Diabetes, boils in, iv. 777.
- DIAGNOSIS, SURGICAL, iv. 927.
- Diaphragm, gunshot wound of, ii. 70; rupture of, 407.
- Diaphragmatic hernia, ii. 409, iv. 288.
- Diathesis, aneurismal, iii. 348; furuncular, iv. 776; hæmorrhagic, i. 656; purulent, 286; scrofulous, 346.
- Diet of patients after operation, iv. 870; in hospital, iv. 1011.
- Diffuse cellular inflammation, i. 237; of larynx, iii. 232; of scalp from injury, ii. 97.
- Diffused aneurism, iii. 347.
- Digestion, symptoms referred to organs of, in respect to diagnosis, iv. 937.
- Digital compression in amputation, iii. 56; pressure in aneurism, 421.
- Dilatation of stricture, iv. 391; gradual, 395; permanent or continuous, 397; sudden (or rupture), 398.
- DIPHTHERIA, iv. 60; tracheotomy in, 70.
- Diploë, inflammation of, after scalp-wound, ii. 99; tumours of, iv. 953.
- Direct inguinal hernia, iv. 311.
- Directors, iv. 1038; for hernia, 278.
- DISLOCATION, i. 811; compound, 824; congenital, iv. 822; partial, i. 823; pathology of, 811; pathological anatomy of, 814; reduction of, 819; unreduced, 816.
- Dislocation of ankle, ii. 655; astragalus, 666; calcaneum, 669; carpus, 585; clavicle, 559; coccyx, 479; cuneiform bones, 670; elbow, 579; elbow, compound, 522, 582; fibula, 655; foot, 659; hip, 636; humerus, 564; hyoid bone, 284; jaw, 266; knee, 652; lens, 731, 737, 806; metatarsus, 671; patella, 650; pelvis, 476; phalanges of hand, 587; compound, 524; phalanges of foot, 672; radio-ulnar joint (lower), 583; scapula, 562; shoulder, 564; compound, 579; spine, 203; thumb, 585; ulna and radius at elbow, 579; upper extremity, statistics of, 525; wrist, 584.
- Dissection-wounds, i. 239, 617.
- Dissecting aneurism, iii. 461.

- Distension of bladder, iv. 356.
 Distoma ophthalmobium, iv. 911.
 Divers, means adopted by, in order to remain under water, iv. 882.
 Dog, bite of rabid, i. 628; hydrophobia in the, 626; tapeworm in, its relation to hydatids in man, iv. 909.
 Dorsal vertebrae, fracture of, ii. 211.
 Dorsum ilii, dislocation of hip on the, ii. 638.
 Double hernia, iv. 283.
 Dracunculus, iv. 914.
 Drainage-tubes, i. 163, 170; in empyema, ii. 374.
 Dressing wounds, principles of, iv. 869.
 Dropsy. See *Paracentesis*.
 Drowning, entrance of air into lungs in, iv. 876; experiments on, 878, 880; mode of death in, 880; complicated with apoplexy, &c. 899; period of submersion consistent with recovery, 883; prognosis of, 899; rules of treatment, 900, 902. See also *Apnœa*.
 Dry gangrene, i. 175.
 Duct-cysts of breast, iv. 680.
 Dumb-bell calculi, iv. 431; crystals in urine, 437, 8.
 Duodenum, ulceration of, in burns, i. 741.
 Dupuytren's bilateral lithotomy, iv. 466.
 Dura mater, extravasation over the, ii. 106; fungous tumour of, iv. 953.
 Duration of disease, in reference to diagnosis, iv. 933.
 Dyspepsia, scrofulous, i. 346.
 Dyspnoea, effects of, on shape of chest, iv. 860.
- EAR, DISEASES OF**, iii. 134; implicating the brain, 185; bleeding from, ii. 259; External, foreign bodies in, 254; gouty and other concretions in, iii. 136; instrument for removing foreign bodies, iv. 1041; malformations of, iii. 134; erysipelas of, 135; tumours of, 136; wounds of, ii. 253; Middle, see *Tympanum*, *Mastoid cells*; Internal, see *Labyrinth*; cancer of, iii. 188; plastic operations on, 127; watery discharge from, in injuries of head, ii. 131.
 Earle's fracture-bed, iv. 1050.
 Ecchymosis, i. 571; colours of, 572.
 Echinococcus, iv. 907; and see *Hydatid*.
 Ecraseur, the, iv. 1040; laryngeal, iii. 257.
 Ectropion, ii. 876.
 Ecthyma, iv. 739; syphilitic, i. 433.
 Eczema, iv. 720; impetiginodes, 721; of ear, iii. 135.
 Eczematous ulcer, i. 200.
 Effusion, inflammatory, i. 27.
 Eighth cranial nerve, injuries of, ii. 177.
 Eiloid, iv. 758.
 Elbow, amputation at, iii. 77; diseases of, 792; dislocations of, ii. 579; excision of, iii. 808; in gunshot wound, ii. 77; in other injuries, 523; fracture into, 544; bend of, aneurism at, iii. 468.
 Electric cautery. See *Cautery, galvanic*.
 Electricity, death from, i. 749.
 Electrolysis in stone, iv. 452.
 Electro-puncture, iii. 23.
 Elephantiasis anæsthetica, iv. 754; Græcorum, 753; pachydermia or Arabum, 755; scroti, 618; tuberculosa, 753.
 Embolism, iii. 333; of veins, 291, i. 274; causing aneurism, iii. 353; leading to spontaneous cure of aneurism, 369.
 Emetics in inflammation, i. 109.
 Emissions, nocturnal, iv. 604.
 Emphysema, ii. 360, iv. 941.
 Empyema, ii. 369.
 Encephalitis, traumatic, ii. 183.
 Encephalocele, iv. 952.
 Encephaloid cancer, i. 523.
 Enchondroma, i. 486, iii. 685; glands affected in, 280; of breast, iv. 684; of face, 120, 959; of testis, 591.
 Encysted calculus, iv. 350, 448; hydrocele, 557; tumour, see *Cysts*.
 Endermic method, iii. 21.
 Enlarged prostate, iv. 365; tonsils, 81; effect of, on shape of chest, 860.
 Enterocoele, iv. 232.
 Enteropneuplocele, iv. 232.
 Entérotôme, ii. 463.
 Entozoa, iv. 902; in bone, iii. 697; in veins, 322.
 Entropion, ii. 876.
 Enucleation of uterine tumour, iv. 501.
 Enuresis. See *Incontinence in children*.
 Epéron in artificial anus, ii. 461.
 Ephelis, iv. 759; lentigo, 759.
 Epicanthus, ii. 874.
 Epicystotomia, iv. 467.
 Epidemic erysipelas, i. 246.
 Epididymitis. See *Orchitis*.
 Epigastrium, blows on, ii. 389; hernia in, iv. 288.
 Epiglottis, wounds of, ii. 272.
 Epilepsy, reflex, iii. 877.
 Epiphora, ii. 865.
 Epiphyses, separation of, i. 759.
 Epiphysial line, diseases of bone at, iii. 621.
 Epiplocele, iv. 232.
 Epistaxis, iii. 209.
 Epithelioma or Epithelial cancer, i. 529; of the face, iv. 960; of the neck, 965; of the nose, iii. 190.
 Epulis, iv. 15.
 Equinia, or glanders, i. 639; mitis, 646.
 Erectile tumour, i. 497.
 Ergot of rye, gangrene from eating, i. 177.
 Erratic erysipelas, i. 232.
 Eruptions of skin, see *Skin, diseases of*; syphilitic in bone, iii. 663; from injury of nerves, 890.

- Eruption, difficult, of wisdom-teeth, iv. 9.
ERYSIPELAS, simple, or cutaneous, i. 220; causes of, 241; ambulans, 232; epidemic, 246; erratic, 232; idiopathic, 221; metastatic, 232; miliary, 230; cedematous, 231; phlegmonous, or cellululo-cutaneous, 233; phlyctenodes, 230; symptomatic, 221; traumatic, 221; universal, 233; of ear, iii. 135; of scalp, ii. 97; glands affected in, iii. 281.
 Erysipelatous laryngitis, iii. 231.
Erythema, i. 224, iv. 714; circinnatum, i. 225, iv. 716; fugax, i. 224, iv. 715; intertrigo, i. 226; læve, 226; marginatum, 225; nodosum, 225, iv. 715; papulatum, 225.
 Escharotics. See *Caustics*.
 Ether, iii. 91.
 Eustachian catheter, iii. 163.
 Eustachian tube, affections of, iii. 159; functions of, 159; obstruction of, 160; patulous, 159.
 Exanthemata, iv. 710, 713.
 Exanthematous ophthalmia, ii. 698; jaw-necrosis, iv. 50.
EXCISION OF BONES AND JOINTS, iii. 796; subperiosteal, 802; for excision of special parts, see the names of those parts, as *Calcaneum*, *Shoulder*.
 Exfoliation of bone, iii. 645.
 Exhalation, hæmorrhage by, i. 652.
 Exomphalos. See *Umbilical hernia*.
 Exophthalmic bronchocele, iv. 702.
 Exophthalmos, ii. 884.
 Exostosis, i. 492, iii. 689; bullous, 693; diffused, 693; ivory, i. 494, iii. 691; malignant, 675; periosteal, 689; of the axilla, iv. 970; of ear, iii. 150; of jaw, iv. 127; of orbit, ii. 885.
 Exstrophy of bladder, iv. 339.
 Extension of ankylosis, gradual, iii. 604; sudden, 611; of cicatrices, 132; of fracture, i. 776.
 Extension-apparatus, iv. 1052.
 External fistula, i. 166, iv. 200; piles, 183; urethrotomy, 405.
 Extra-capsular fracture of cervix femoris, ii. 600.
 Extraction of cataract, ii. 821; linear, 846; through the sclerotic, 845; of teeth, hæmorrhage after, iv. 53.
 Extra-uterine pregnancy, operations in, iv. 512.
 Extravasation of blood in injuries of the abdomen, ii. 400; of the head, 104; of fæces, from laceration, 412; from punctured wound, 448; of urine, iv. 421; from ruptured kidney, ii. 422; from ruptured ureter, 424; from injury of urethra, ii. 491.
 Extremity, lower, contusions of, ii. 588; gunshot wounds of, 78; **INJURIES OF**, 588; sprains of, 591; wounds of, 590; upper, contractions of, iii. 587; gunshot wounds of, ii. 75; **INJURIES OF**, 517; sprains of, 517; wounds of, 519.
 Extroversion of the bladder, iv. 339.
 Exuberant ulcer, i. 215.
 Exudation, diphtheritic, iv. 65; inflammatory, i. 27.
EYE, DISEASES OF, ii. 673; entozoa in, ii. 703, 726, 791, iv. 907; injuries of, 730, and see special parts, as *Conjunctiva*, *Cornea*.
 Eyeball, cancer of, ii. 856; scrofulous deposit in, 856; dislocation of, 884; removal of, 892; rupture of, 731.
 Eyebrow, wound of, ii. 252.
 Eye-instruments, iv. 1048.
 Eyelids, cancer of, ii. 883, iv. 961; diseases of, ii. 873; inflammation of, 877; injuries of, 883; tumours of, 880; wounds of, 253.
 Face, canceroid ulceration of, iv. 960; carbuncle of, 786; contusions of, ii. 246; cysts of, iv. 957; enchondroma of, 120, 959; epithelioma of, 960; gunshot wounds of, ii. 53; hypertrophy of bones of, iv. 120, 959; **INJURIES OF**, ii. 245; malformations, iv. 806; nævi of, 108; regional surgery of, 956; tumours, 120; wounds of, ii. 251.
 Facets of calculi, iv. 431.
 Facial nerve, wound of, in operation, iv. 958. See also *Seventh cranial*.
 Fæcal abscess, iv. 149; fistula congenital, 818.
 Fæces, extravasation of, from laceration, ii. 412; from wound, 448.
 Fallopian tube, inflammation, gonorrhæal, iv. 652; rupture, after operation for imperforate hymen, 495.
 False aneurism, iii. 346; joint, see *Fracture ununited*; passages in urethra, iv. 396.
 Farcy, i. 640; flying, 642.
 Fascia, contraction of palmar, iii. 588; propria of Astley Cooper, iv. 312.
 Fasciola hepatica, iv. 911.
 Fatty degeneration, inflammatory, i. 9; non-inflammatory, 12.
 Fatty tumour, i. 476; congenital, iv. 805; of abdomen, 973; of neck, 962; of pharynx, 142; of scrotum, 620; under conjunctiva, ii. 703.
 Fauces, inflammatory affections of, iv. 80; acute, 85; tumours of, 87; scald of, 897.
 Favus, iv. 727. Febrifuges, i. 110.
 Femoral aneurism, iii. 510.
 Femoral artery, ligature of common, iii. 511; of superficial, 506.
 Femoral hernia, iv. 312; development of, 313; diagnosis of, 314; morbid states of, 317; operation for, 318; statistics of, 316; varieties of, 313; wound of obturator artery in operation for, 319.

- Femoral ring, passage of testicle through, iv. 546.
- Femur, dislocation of, see *Hip*; fracture of neck of, ii. 593; of shaft of, 610; of lower end of, 619; necrosis of, in popliteal space, iii. 645, iv. 982; section of, in ankylosis of hip, iii. 614.
- Fergusson's lion-forceps, iv. 1045; saw, 1043.
- Ferments, i. 67.
- Fever, hectic, iv. 861; inflammatory, i. 45; SURGICAL, iv. 861; traumatic, i. 582, iv. 865.
- Fibrine, disorganised, in blood, i. 288; its function in the body, 55; in inflammatory exudations, 29; in inflammatory blood, 53; in inflammatory effusion, 27.
- Fibrinous calculus, iv. 441.
- Fibro-cellular tumour, i. 479.
- Fibro-muscular tumour, i. 483.
- Fibro-plastic tumour, i. 479; of breast, iv. 685; of uterus, recurrent, 498.
- Fibroid recurrent tumour, i. 503.
- Fibrous polypus of nose, iii. 218.
- Fibrous tumours, i. 482; of bladder, iv. 350; of bone, iii. 696; of ear, 137; of jaws, i. 485, iv. 123; of testis, 593; of uterus, 500.
- Fibula, dislocation of head of, ii. 655; fracture of, ii. 600.
- Fifth cranial nerve, injuries of, ii. 175; paralysis of, 886.
- Figure-of-8 bandage, iii. 3; suture, 16.
- Filaria lentis, iv. 917; medinensis, 914.
- Fimbriae of synovial membrane, iii. 737.
- Finance of hospitals, iv. 1031.
- Fingers, amputation of, ii. 523, iii. 74; chancre of, i. 413; dislocation of, ii. 587; division of tendons of, iii. 609; enchondroma of, 687; fracture of, ii. 558; supernumerary, iv. 821; webbed, 821.
- First intention, union by, i. 584.
- Fissure of anus, iv. 210.
- Fistula, i. 165; complete and incomplete, 166; external and internal, 166; formation of, 167; anal, or in ano, iv. 199; operation for, 203; biliary, ii. 453; congenital, iv. 818; gastric, ii. 450; lachrymal, 865; salivary, 253; urinary or perineal, iv. 412; operations for, iii. 128; urethro-rectal, iv. 414; vaginal and uterine, 536; vesico-rectal, 414.
- Fistulae, establishment of, in ovarian dropsy, iv. 524.
- Fit, hysterical, i. 361.
- Flap-amputation, iii. 57; Teale's, by rectangular flaps, 60.
- Flaps, transplantation of, iii. 112.
- Flat-foot, iii. 585.
- Flexion-treatment of aneurism, iii. 425.
- Floating tumours, i. 506; of abdomen, iv. 975.
- Fluctuation, iv. 942.
- Fœtus, syphilis in the, iv. 831.
- Fœtus in fœtu, iv. 802.
- Follicular ulcer of nose, iii. 194.
- Foot, dislocation of, at tarsus, ii. 659; fungous disease of, iv. 919; fractures of, ii. 634. See also *Tarsus*.
- Forceps, artery, iv. 1038; bone, 1045; bone-cutting, 1045; bullet, ii. 37; dressing, iv. 1038; lithotomy, 453, 1048.
- Forcing a stricture, iv. 418.
- Forearm, amputation of, iii. 76; fractures of, ii. 546, 548, 556. See also *Radius*, *Ulna*.
- Foreign bodies in abdominal cavity, ii. 472; air-passages, 294; antrum, 256; bladder, 496; chest, 366; conjunctiva, 674; cornea, 723; ear, 254; gunshot wounds, 17; nose, 256; rectum, 515; stomach and intestines, 466; vagina, 512; wounds, i. 606.
- Fourth cranial nerve, injuries of, ii. 174; paralysis of, 888.
- Four-tailed bandage, iii. 7.
- FRACTURE, i. 753; comminuted, 760; compound, 757, 778, 789, 791; in upper extremity, ii. 522; dentate, i. 758; fissured, 761; from muscular action, 755; gunshot, ii. 7, 11; incomplete, i. 761; into joints, 782; intra-uterine, 756, iv. 826; multiple, i. 760; oblique, 758; simple, 757; splintered, 760; spontaneous, iii. 701; transverse, i. 758; V-shaped, 758; union of, 785; deformed, 807; treatment by refracture, 808; delayed by coagulation in veins, iii. 300; by ligature of main artery, 447; ununited, i. 793; aneurism from, iii. 442; of rickety bones, iv. 841. For fracture of individual bones, see their names.
- Fracture-apparatus, iv. 1050.
- Fragilitas ossium, iii. 670.
- Fragments lodged in gunshot wounds, ii. 15.
- Framboesia, iv. 756.
- Friction in ununited fracture, i. 800.
- Frontal sinus, distension of, iv. 958; fracture into, ii. 113.
- Frost-bite, i. 191.
- Fuller's tracheotomy trocar, iv. 1046.
- Fumigation, mercurial, i. 421.
- Fungous tumour of dura mater, iv. 953.
- Fungus of brain, ii. 165.
- Fungus hæmatodes, i. 526.
- Fungus-disease of India, iv. 919.
- Funicular portion of peritoneum, hernia into, iv. 295.
- Fusible calculus, iv. 440.
- Fusiform aneurism, iii. 344.
- Furunculus. See *Boil*.
- Furuncular diathesis, iv. 776.
- Gait in lateral distortion of spine, iv. 847.
- Galactocoele, iv. 682.
- Galactorrhœa, iv. 676.

- Gall-bladder, fistula of, ii. 453; rupture of, 418.
- Gall-duct, rupture of, ii. 418.
- Galvanic cautery, see *Cautery*; instrument for, iv. 1041.
- Galvanism in ununited fracture, i. 799; in accidents from chloroform, iii. 106; treatment of aneurism by, 432.
- Ganglion, iii. 555.
- Gangrene, i. 6, 173; causes of, 174; from atheroma of vessels, iii. 331; from embolism, 336; from ligature of artery, i. 694, iii. 404; hospital, i. 186; inflammatory, 176; moist and dry, 175; secondary, 185; senile, 193, iii. 336; traumatic, i. 183; separation of, 179; treatment of, 181; amputation in, 183; in childhood, iv. 838; of penis, 622.
- Gangrenous stomatitis. See *Cancerum oris*.
- Gases, suffocation in non-respirable, iv. 884; in poisonous, 885.
- Gastric fistula, ii. 450.
- Gastrocele, iv. 233, 290.
- Gastrotomy, or opening the stomach, ii. 336. Opening the intestine, see *Colotomy*.
- Gelatinous cancer, see *Colloid*; polypus of nose, iii. 211.
- Genital organs, gunshot wounds of, ii. 72; female, injuries of, 512; phenomena of, in reference to diagnosis, iv. 938. See also *Male organs*, *Female organs*, and the names of the various parts.
- Genu valgum, iii. 597.
- Giants, proportions of figure in, iv. 855.
- Glands (lymphatic), hypertrophy and atrophy of, iii. 269; inflammation of, 267; scrofulous disease, i. 250, iii. 271; syphilitic disease, i. 444; of cervical, iv. 964; excision of, iii. 283, iv. 970. See also *Lymphatics*.
- Glanders, i. 639; chronic, 644; in man, 641; in the horse, 639.
- Glandular tumour, i. 495.
- Glans. See *Penis*.
- Glaucoma, acute, ii. 850; chronic, 849; iridectomy in, 853.
- Gleet, iv. 636; treatment of, 650.
- Glenoid cavity of scapula, fracture of, ii. 535.
- Globus hystericus, i. 362.
- Glossitis, iii. 900.
- Glottis, burns and scalds of, ii. 288; cedema of, iii. 228; spasm of, 241. See also *Larynx*.
- Gluteal aneurism, iii. 520.
- Goitre. See *Bronchocele*.
- GONORRHOEA, iv. 626; causes of, 630; Hunter's experiments on, 627; pathology of, 629; seat of, 633; in the male, its stages, 634; its varieties, gonorrhœa sicca, 638; balanitis, 638; its complications, chordee, iv. 635; renal and vesical irritation, 638; bleeding from urethra, 639; lacunar abscess, 639; bubo, 639; phimosis and paraphimosis, 640; chronic prostatitis, 643; epididymitis, 570; ophthalmia, ii. 688; rheumatism, iii. 734; its treatment, iv. 645; in the female, 650; complications, 652; treatment, 652.
- Gorget, iv. 453.
- Gouty concretions in ear, iii. 136; synovitis, 729; ulcer, i. 206.
- Granular conjunctiva, ii. 688.
- Granulations, i. 585; morbid, 610; union by, 584.
- Grape-shot, wounds by, ii. 6.
- Gravel, iv. 425.
- Greenstick fracture. See *Bending of bones*.
- Groin, cysts of, iv. 978; diagnosis of tumours in, 305; enlarged glands of, 977; phagedæna of, 978.
- Grooved needle, iv. 1040.
- Guinea-worm, natural history, iv. 914; symptoms of, 916; method of extraction, 917.
- Gum, adhesion of, to cheek, ii. 258; congenital hypertrophy of, iv. 18; polypus of, 20; tumours of, 14; vascular, 22.
- Gumboil, iv. 3.
- Gum-bandage, iii. 9.
- Gunpowder, accidents from, i. 726.
- GUNSHOT WOUNDS, ii. 1; amputation in, 84; anæsthetics in, 91; apertures of entrance and exit, 25; excision in, 77, 84; hæmorrhage in, primary, 30, secondary, 86; hospital gangrene and pyæmia in, 90; injuries of arteries, 31, of nerves, 87; lodgment of balls in, 13; numerous, from one ball, 27; pain of, 28; shock in, 28; symptoms (general) of, 23; tetanus in, 89; treatment (general) of, 33; of the abdomen, 65; chest, 55; diaphragm, 70; face, 53; genito-urinary organs, 71; head, 43; heart, 62; lower extremity, 78; neck, 63; pericranium, 43; perinæum, 71; scalp, 43; skull, 46; spine, 51; upper extremity, 75.
- Gustatory nerve, division of the, iii. 915.
- Gutta-percha splints, iii. 10.
- Gynæcomazia, iv. 656.
- Gypsum-bandage, iii. 9.
- Habits, in reference to diagnosis, iv. 931.
- Hæmatocoele, iv. 564; encysted, 566; of neck, i. 467; iv. 962.
- Hæmatoma, i. 574; auris, iii. 137. See also *Blood-tumour*, *Cephalæmatoma*.
- Hæmaturia, iv. 334; causes of, 335; sources of, 335; treatment of, 336.
- Hæmorrhage, i. 580, 650; periodical, 655; recurring, 602; secondary, 604; after ligature, 676; after gunshot, ii. 86; after extraction of teeth, iv. 53;

- vicarious, i. 655; its relation to collapse, 711; in gunshot wounds, ii. 30; from nose, iii. 209. See also injuries of the various parts.
- Hæmorrhagia, iv. 711, 719.
- Hæmorrhagic diathesis, i. 656; ulcer, 216.
- Hæmorrhoids, external, iv. 183; internal, 186; urethral, 491.
- Hæmostatics, i. 663.
- Hæmothorax, ii. 364.
- Hair, loss of, from lightning, i. 750; diseases of, iv. 761; tumours containing, i. 472.
- Hamstring muscles, division of, iii. 608.
- Hand, amputation of, iii. 76; aneurism in, 467; congenital deformities, iv. 821; diseases of joints of, iii. 793; excision of bones of, 813; fractures of, ii. 556; needles in, 520; suppuration in, i. 160, ii. 529, iii. 554; wounds and laceration, ii. 519, 520, 523; by gunshot, 77.
- Hanging, mode of death by, iv. 879.
- Harelip, iii. 121; suture, 15.
- Head, gunshot wounds of, ii. 43; INJURIES OF THE, 96; regional surgery of, iv. 947.
- Healing. See *Union*.
- Hearing, use of the sense of, in diagnosis, iv. 943; affections of, see *Ear*.
- Heart, gunshot injuries of, ii. 62; rupture of, 387; wounds of, 376; post-mortem condition in apnoea, iv. 875.
- Heat, Chossat's experiments, i. 50; in fever, 47; in inflammation, 40.
- Hectic fever, iv. 861; flush, 862.
- Hemeralopia, ii. 864.
- Hemiplegia, in injuries of the head, ii. 102, 107.
- Hereditary predisposition to cancer, i. 552; syphilis, iv. 829; tendencies in reference to diagnosis, 931.
- Hermaphroditism, iv. 819.
- HERNIA, iv. 227; diaphragmatic or phrenic, ii. 409, iv. 288; encysted, 302; epigastric, 288; femoral or crural, 312, see *Femoral*; inguinal, 291, see *Inguinal*; ischiatic, 326; lumbar, 291; obturator, 319; perineal, 325; pudendal, 326; scrotal, 302, 305; umbilical, 289; vaginal, 326; ventral, ii. 400, 431, iv. 289; double, 283; complicated with retained testis, 544; contents of, 232. Sac of, development of, 237; kinds of congenital and acquired, 239; fluid in, 254; laceration of, 271; displacement of, 270; intraparietal, 272. Morbid states of, irreducible, 246; obstructed, 247; inflamed, 247; strangulated, 248. Injuries of, 269; gangrene of intestine in, 251, 279; contusion of, 252; treatment, taxis in, 263; injurious effects of, 262, 268; operation, see *Herniotomy*; trusses, use of, 240; radical cure of, 242, 308; réduction en bloc, 270; rupture of intestine in, 266; treatment of ruptured intestine, 275; ulceration of gut in, 251; use of chloroform in, 265; use of ice in, 267; vomiting in, 256, 257; from artificial anus, ii. 458.
- Hernia of the bladder, iv. 354; of the brain, ii. 163; congenital, iv. 952; spontaneous cure of, 952; of the lung, ii. 355; of the testis, iv. 567.
- Hernies graisseuses, iv. 974.
- Herniotomy, iv. 272; see also the different forms of hernia, as *Femoral*; after treatment, 283; instruments required in, 278; question of opening the sac in, 276; treatment of gangrenous intestine in, 279; treatment of ruptured intestine in, 275; treatment of omentum, 282.
- Herbert hospital, Woolwich, plan of, iv. 1003.
- Herpes, iv. 723; circinnatus, 724; labialis, 723; preputialis, 644; zoster, 723.
- Hexacanthus of taniada, iv. 905.
- Hey's amputation, iii. 80; saw, iv. 1043.
- High operation for lithotomy, iv. 467.
- Hip-joint, amputation at, iii. 89; for gunshot, ii. 82; congenital dislocation of, iv. 822. Diseases of, viz. common inflammation, iii. 778; neuralgia, 784; senile or arthritic disease, 783; strumous disease, morbus coxarius or coxalgia, 778; spontaneous dislocation in, 780; diagnosis, 781; treatment, 783. Dislocations of, ii. 636; anomalous, 647; into obturator foramen, 645; into sciatic notch, 644; on dorsum ilii, 638; on pubes, 646. Division of muscles in ankylosis of, iii. 609; section of neck of femur in ankylosis of, 814; excision of, 813; for gunshot injury, ii. 82; fractures into, 477, 594.
- Holt's stricture-dilator, iv. 399.
- Hordeolum, ii. 877.
- Horns, iv. 772.
- HOSPITALS, iv. 983.
- Hospital gangrene, i. 186.
- Housemaid's knee, iii. 548.
- Hulke's needle, iv. 1050.
- Humerus, dislocations of, ii. 564; subcoracoid, 565; subglenoid, 570; subclavicular, 572; supracoracoid, 573; subspinous, 573; partial, 574; compound, 579; congenital, iv. 822; fractures of, ii. 535; into elbow-joint, 544; of anatomical neck, 536; of great tuberosity, 540; of inner condyle, 544; of lower end, 542; of shaft, 540; of surgical neck, 538; of upper end, 536; of upper epiphysis, 537; tumours and exostoses of upper end of, iv. 970.
- Hump in angular curvature, iii. 833; in lateral curvature, iv. 845.

- Hunter's operation for aneurism, iii. 389; indications for, 410; experiments on gonorrhœa, iv. 627.
- Hunterian chancre, i. 400.
- Hydatids, iv. 908; connection of with tænia, 909; distribution of, 909; growth of, 909; treatment, 910; in bone, iii. 697; in breast, iv. 685; in liver, 976; in neck, 965; in orbit, ii. 385; in prostate, iv. 381.
- Hydatid disease of testis, see *Cystic*; of breast, see *Adenocoele*.
- Hydrarthrosis, iii. 715.
- Hydrocele, iv. 547; congenital, 550; encysted, 557; infantile, 557; of the cord, 661; combination with hernia, 552; diagnosis of, 551; condition of testicle in, 549; position of testicle in, 548; treatment by tapping, 554; injection, 554; other methods, 556.
- Hydrocele of neck, iv. 962.
- Hydrocephalus, iv. 955.
- Hydrophobia, i. 625, 628, iii. 883; hysterical, i. 632.
- Hydrops articuli, iii. 715.
- Hydrops pericardii, paracentesis for, ii. 379.
- Hydrorachitis. See *Spina bifida*.
- Hydrosarcocele, iv. 576.
- Hydrothorax, ii. 369.
- Hygiène of hospitals, iv. 1004.
- Hymen, imperforate, iv. 493.
- Hyoid bone, dislocation of, ii. 284; fracture of, 283, iv. 898.
- Hypertrophy of bladder, iv. 349; of bone, iii. 699; of breast, iv. 666; of glands, iii. 269; of gums, iv. 18; of jaw, 128; of prostate, 365; of tongue, iii. 897; of veins, 306; reflex, 890.
- Hypochondriasis, i. 367.
- Hypodermic injection, i. 334, iii. 22, 893.
- Hypogastric lithotomy, iv. 467.
- Hypopyon, ii. 713.
- Hypospadias, iv. 382.
- HYSTERIA, i. 361; causes of, 370; pathology, 368; treatment, 372; in the male, 367; reflex, iii. 881.
- Hysterical affection, local, i. 361; of the breast, 365; of the joints, 364; of the larynx, iii. 239; of the spine, i. 363.
- Hysterical hydrophobia, i. 632; pain, 365; retention of urine, 365.
- Hystrix, iv. 760.
- Ice, as antiphlogistic, i. 99; use of, in hernia, iv. 267.
- Ichthyosis simplex, iv. 760; cornea, 760; spuria v. sebacea, 761.
- Iliac abscess, iii. 848; artery, ligature of external, 513; ligature of common, 516; ligature of internal, 521.
- Iliac fossa, fibrous tumour of, iv. 974.
- Ilium, dislocation of hip on dorsum of, ii. 638.
- Immediate union, i. 583.
- Impacted fracture, i. 761.
- Impaired vision, ii. 763.
- Imperforate anus, iv. 812; hymen and vagina, 493.
- Impermeable stricture, iv. 405.
- Impetigo, iv. 737; syphilitic, i. 433.
- Impotence, iv. 607, 609.
- Incarcerated hernia, iv. 247.
- Incised wound, i. 578.
- Incisions in inflammation, i. 112; in diffuse cellulitis, 263.
- Incomplete dislocation, i. 823; fistula, 166; fracture, 761.
- Incontinence, iv. 358; in youth, 359.
- Indolent ulcer, i. 217.
- Indurated chancre, i. 400.
- Induration after injury, i. 575.
- Infancy, inflammation of breast in, iv. 668; proportions of body in, 853.
- Infantile inguinal hernia, iv. 302; leucorrhœa, 839; paralysis, 835; syphilis, 831.
- Infants, artificial respiration in, iv. 897; tetanus in, i. 304.
- Inflamed ulcer, i. 216.
- INFLAMMATION, i. 1; changes of circulation in, 16; changes of local blastema in, 25; changes of textural elements in, 29; coagulation of blood in, 53; determining causes of, 57; etymology of, 2; from burns, 737; from extravasation, 575; literature of, 132; predisposing causes, 77; reflex, iii. 888; symptoms of, i. 35; treatment of, 93; of special organs, see their names.
- Inflammatory blood, i. 53; effusion, 27; fever, 45; gangrene, 176; heat, 40; pain, 37; process, 3; redness, 35; softening, 7; stasis, 21; stricture, iv. 409; swelling, i. 36; ulcer, 199.
- Inflation of lungs, iv. 894; of intestines in intussusception, 177.
- Infusoria, parasitic, iv. 903.
- Ingrown toenail, iv. 795.
- Inguinal aneurism, iii. 512.
- Inguinal hernia, iv. 291; abnormal, 312; direct, 311; oblique, into vaginal process of peritoneum, 292; into funicular portion of the vaginal process, 295; hour-glass contraction of sac, 298; infantile, 302; common form, 302; radical cure of, 308; taxis of, 309; operation for, 310; in the female, 310.
- Injections in abscess, i. 163; in aneurism, iii. 435; in gonorrhœa, iv. 645, 647; in intussusception, 177; in ovarian dropsy, 525.
- Injuries of, see the names of the parts injured.
- INNOCENT TUMOURS, i. 463.
- Innominate artery, aneurism of, iii. 480; ligature of, 484.

- Inoculation of ophthalmia, i. 69, ii. 681; for granular lids, 690; of syphilis, i. 377; of secondary syphilis, 380; of secondary syphilis on persons previously diseased, 404.
- Insects, parasitic, iv. 918; venomous, 921, 922.
- Insolation, i. 726.
- INSTRUMENTS, SURGICAL, iv. 1037.
- Intention, first, i. 584; second, 584; third, 587.
- Interarticular cartilages of knee, subluxation of, ii. 653.
- Intercostal vessels, wound of, ii. 379.
- Intermaxillary portion in double hare-lip, iv. 90.
- Internal fistula, i. 166; mammary artery, wound of, ii. 382; piles, iv. 186; pudic artery, wound of, ii. 510; urethrotomy, iv. 401.
- Interrupted suture, iii. 13.
- Interstitial nutrition, effects of its arrest, iv. 887.
- Intertrigo, i. 226.
- Intestines, cancer of, iv. 170; foreign bodies in, ii. 466, 471; gunshot wounds of, 67. Obstruction of, iv. 152; from congenital malformation, 154; from foreign bodies, ii. 465; from twist or displacement, iv. 155; from loops of false membrane, 159; from rings of peritoneum, 159; from intussusception, 161; from habitual constipation, 166; from injury, ii. 396; from peritonitis, iv. 167; from stricture, 168; from cancer, 170; operations for, see *Colotomy*. Protrusion of, from wound, ii. 431; rupture of, 411; ulceration of, in burns, i. 741; wounds of, ii. 440, 446. See also *Hernia*.
- Intra-capsular fracture of cervix femoris, ii. 594.
- Intra-cranial aneurism, iii. 494.
- Intra-fœtation, iv. 802.
- Intra-orbital aneurism, iii. 490.
- Intra-uterine fracture, i. 756, iv. 826.
- Intussusception, iv. 161.
- Inversion of bladder, iv. 354.
- Inversion of patient's body in foreign bodies in the air-passages, ii. 307; in hernia, iv. 268.
- Iodine injection in hydrocele, iv. 554; in hydrocele of neck, 963; in hydrops articuli, iii. 716; in ovarian dropsy, iv. 525; in popliteal cysts, 981; in spina bifida, 810.
- Iridesis, ii. 760.
- Iridectomy, ii. 853.
- Irideremia, ii. 732.
- Iris, congenital malformation, ii. 732; cysts of, 752; detachment of, 736; diseases of, 732; inflammation, see *Iritis*; prolapsus of, after extraction of cataract, 836.
- Iritis, ii. 734; arthritic, 749; gonorrhœal, 749; rheumatic, 738; scrofulous, 748; syphilitic, 741; in infants, 746; traumatic, 736; sequelæ of, 751.
- Iron in erysipelas, i. 256; perchloride of, injection of in aneurism, iii. 435; in nævus, i. 501.
- Irreducible hernia, iv. 246.
- Irritable bladder, iv. 357; mamma, 675; testis, 610; ulcer, i. 216.
- Ischiatic hernia, iv. 326.
- Issues, iii. 23.
- Ivory exostosis, i. 494, iii. 691.
- Ivory pegs in ununited fracture, i. 805.
- Jaw, bandage, iii. 7; lower, disease of joint of, 794; disease of joint of, excision for, 829; dislocation, ii. 268; congenital, iv. 822; fracture of, ii. 261; removal of, iv. 134; upper, fracture of, ii. 261; removal of, iii. 222, iv. 137; for naso-pharyngeal polypus, iii. 222; osteoplastic resection, iv. 138.
- Jaws, cysts of, iv. 32; necrosis, 39; necrosis exanthematous, 50; phosphorus disease of, 39; tumours of, 119, cancerous, 130.
- Jigger or chigoe, iv. 918.
- JOINTS, DISEASES OF, iii. 703; abscess in, 709; abscess near, i. 151; ankylosis of, iii. 766; EXCISION OF, 796; dropsy of, 715; fractures extending into, i. 792; gunshot wounds of, 75, 78; hysterical affection of, i. 364; scrofulous disease of, iii. 741; tumours of, 751; wounds of, 774. See also the names of the various structures, as *Cartilage*, *Synovial membrane*.
- Joint, false, i. 794.
- Jugular vein, bleeding from, iii. 34; division of, in operation, iv. 968.
- Junod's boot, iii. 32.
- Kelis or Keloid, iv. 756; growth of scars, i. 614; true, of Addison, iv. 757.
- Kelotomy. See *Herniotomy*.
- Keratitis, ii. 708; interstitial or syphilitic, 711; with suppuration, 713.
- Keratonyxis, ii. 817.
- Kidneys, abscess of, iv. 333; affection of, in fractured spine, ii. 224; calculous nephralgia, iv. 331; inflammation, nephritis, 329; chronic, 334; malformations, 329; neuralgia, 331; rupture of, ii. 420; pyelitis, calculous, iv. 331; renal hæmaturia, 334; suppression of urine, 337.
- Knee, amputation at, iii. 87; ankylosis of, 600; diseases of, 786; dislocation of, ii. 652, compound, 654, congenital, iv. 822; division of muscles for ankylosis of, iii. 608; excision of, 817; for gunshot injury, ii. 84; fracture into, 619; hysterical affection, i. 364; wounds of, iii. 788.
- Knee, housemaid's, iii. 548.

- Knives, amputating, iv. 1042; hernia, 278; lithotomy, 453.
 Knock-knee, iii. 597.
- Labia, adhesion of, iv. 492; abscess of in gonorrhœa, 652; tumours of, 510, 511.
- Labyrinth, affections of, iii. 181.
- Lacerated wound, i. 599; of hand, ii. 523; of upper extremity, 522.
- Laceration of inner coats of artery, i. 672; of outer coats of artery, 680; of brain, ii. 152; of perineum, ii. 513, iv. 515; of urethra, ii. 490.
- Lachrymal apparatus, diseases of, ii. 865; fistula, 865; gland, diseases of, 872.
- Lactation, effect of, on cancer, i. 548; on structure of breast, iv. 659; inflammation of breast in, 669.
- Lacunar abscess, iv. 635.
- Lancets, iv. 1038.
- Lariboisière hospital, plan of, iv. 995.
- Laryngeal snare or écraseur, iii. 257; forceps, iv. 1045.
- Laryngitis, acute, iii. 224; chronic, 243; erysipelatus, 231.
- LARYNGOSCOPE, iii. 251.
- Laryngotomy, ii. 310.
- Laryngo-tracheotomy, ii. 314.
- LARYNX, DISEASES OF, iii. 224; burns and scalds of, ii. 288; contusions of, 282; diffuse inflammation of, iii. 232; disease of cartilages of, 249; foreign bodies in, ii. 303; fracture of cartilages of, 285; hysterical affection of, iii. 239; injury from corrosive liquids, ii. 330; obstruction from substances swallowed, 294, iv. 895; syphilitic ulceration of, iii. 234; tumours of, 235; cancerous tumours of, 239; wounds of, ii. 271.
- Lateral distortion of spine. See *Curvature*.
- Lateral sinus, injuries of, ii. 106; affections of, in disease of the ear, iii. 185.
- Laundries, hospital, iv. 992.
- Leeching, iii. 29.
- Leg, amputation of, iii. 85; fracture of, ii. 626; and see *Extremity, lower*.
- Lens, abnormal position of, ii. 793; dislocation of, 731, 737, 806; diseases of, 792. See also *Cataract*.
- Lenses for examining the eye, iv. 1049.
- Lentigo, iv. 758.
- Lepoid, iv. 759.
- Leprosy, see *Psoriasis*; syphilitic, i. 428.
- Leprosy, the Eastern, iv. 753; anæsthetic, 754.
- Leucoma, ii. 719.
- Leucorrhœa, diagnosis from gonorrhœa, iv. 651; infantile, 839.
- Lichen, iv. 741; agrius, 742; syphilitic, i. 427.
- Lids, granular, ii. 688. See *Eyelids*.
- Ligaments, diseases of, iii. 761.
- Ligature of arteries, i. 674, iii. 464; for individual arteries, see their names; rules for, in hæmorrhage, i. 689; for aneurism, iii. 397.
- Ligature, treatment of cancer by, i. 569; of piles by, iv. 190; of ununited fracture by, i. 802; of polypus of nose by, iii. 216; subcutaneous, 46.
- Lighting of hospitals, iv. 998.
- Lightning, accidents from, i. 749.
- Limbs, malformations of, iv. 820.
- Lime, carbonate of in urine, iv. 428, calculus, 440; phosphate of in urine, 428, calculus, 439.
- Linea alba, hernia in, iv. 974.
- Lingual artery, ligature of, iii. 499.
- Lion-forceps, iv. 1045.
- Lip, lower, restoration of, iii. 124; upper, restoration of, 126; cancer of, iv. 110; chancre of, 110; cracks of, 106; cysts of, 113; malformations of, 806, and see *Harelip*; nævus of, 108; wounds of, ii. 254.
- Lipoma of breast, iv. 683; caudal, 805.
- Lippitudo, ii. 866, 879.
- Liquefaction, inflammatory, i. 7.
- Lisfranc's amputation, iii. 80.
- Liston's forceps, iii. 73; splint, ii. 615.
- Lithectasy. See *Urethra, female*.
- Lithic-acid calculus, iv. 435; deposits, 425.
- Lithontriptics, iv. 451.
- Lithotome caché, iv. 465.
- LITHOTOMY, iv. 452; perineal, 453; lateral, 453; with straight staff, 456; modifications of, 465; bilateral, 466; median, 466, 470; recto-vesical, 467; hypogastric, or the high operation, 467; instruments required, 453; causes of death in lateral lithotomy, 460; statistics of, 461; at different ages, 462; at Norwich, 462; repetition of, 463; in the female, 476; comparison with lithotrixy, 486.
- Lithotrite, iv. 479, 1048; introduction of, 480.
- LITHOTRITY, iv. 478; history of, 478; preliminary proceedings, 479; injections in, 480; different methods of seizing the stone, 480; repetition of, 483; removal of fragments after, 484; difficulties and complications, 484; chloroform in, 486; comparison with lithotomy, 486; statistics of, 488, 490; in hospitals, 490; in the female, 476; for foreign bodies, ii. 489.
- Litré's operation, iv. 179.
- Live blood, the, ii. 879.
- Liver, cysts of, iv. 976; hydatids in, 976; gunshot wound of, ii. 67; rupture of, 415.
- Liver-fluke, iv. 911.
- Local hysterical affections, i. 366; pyæmia, 267; syphilis, 446.

- Locomotive organs, symptoms connected with, in reference to diagnosis, iv. 938.
- Lodgment of balls, ii. 13.
- Long sight, ii. 861.
- Loose cartilages, iii. 725, 736.
- Lower extremity. See *Extremity*.
- Lower jaw. See *Jaw*.
- Luke's fracture-bed, iv. 1050.
- Lumbago, iv. 331.
- Lumbar abscess, iii. 853; glands implicated in cancer of testicle, iv. 598; hernia, 291; vertebræ, fracture of, ii. 210.
- Lucifer-match-makers' disease, iv. 39.
- Lung, condition of, after death by apnoea, iv. 875; entrance of water into, in drowning, 876; hernia of, ii. 355; rupture of, 385; wound of, 358.
- Lupoid ulcer, i. 210.
- Lupous ulcer, i. 209; of face, iv. 960.
- Lupus, iii. 191, iv. 750; exedens, 751; non-exedens, 752; erythematous, 752.
- Lymph, i. 29; compared with tubercle, i. 343.
- Lymphatics, inflammation of, iii. 260; morbid contents of, 282; obstruction of, 283; varix of, 283; wounds of, 259; in cancer, 276; in erysipelas, 281; in gonorrhœa, 276, iv. 639; in innocent diseases, iii. 279; in nævi, 282; in struma, 271; in syphilis, 275; in ulcers, 281.
- Lymphatic glands. See *Glands*, also their names, as *Cervical*.
- Macroglossia, iii. 897.
- Maculæ, iv. 712, 758.
- Mad animals, bites of, i. 625.
- Malar bone, fracture of, ii. 261.
- MALE ORGANS, DISEASES OF, iv. 539.
- Malformations. See the various organs; also *Congenital*, *Fætus*, *Limbs*.
- Malignant disease. See *Cancer*.
- Malignant pustule, iv. 789.
- Mamma. See *Breast*.
- Mammary abscess, i. 155, iv. 670; glandular tumour, or chronic m. tumour, see *Adenocœle*.
- Manipulation-treatment of aneurism, iii. 428.
- Many-tailed bandage, iii. 8.
- Marshall Hall's method of artificial respiration, iv. 893.
- Masseter muscle, spasmodic contraction of, iv. 10.
- Mastoid cells, affections of, iii. 180.
- Masturbation, consequences of, iv. 603, 931.
- Maunder's gag, iv. 14.
- Maxilla. See *Jaw*.
- Mentus auditorius, abscess of, iii. 141; inflammation of, 142; polypus of, 146; syphilitic disease of, 146; urinarius, female, vascular tumour of, iv. 491.
- Median lithotomy, iv. 466; statistics of at Norwich, 70.
- Mediastinum, wounds of, ii. 374.
- Medulla oblongata, contusion of, ii. 154; spinalis, see *Spinal*.
- Medullary cancer, i. 523.
- Medullary membrane of bone, inflammation of, iii. 628.
- Meibomian follicles, abscess of, ii. 878.
- Melanosis, i. 527; of eye, ii. 851.
- Membrana pupillaris, persistence of, ii. 733.
- Membrana tympani, artificial, iii. 158; deposits in, 155; diseases of, 150; examination of, 137; inflammation of, 152; injuries of, 151; perforation of, 156; puncture of, 165; relaxation and tension of, 154; ulceration of, 155.
- Meningitis, cerebral traumatic, ii. 100; spinal, after fracture, 243; after operations for spina bifida, iv. 811.
- Meningocele, iv. 952.
- Menstruation, vicarious, i. 655.
- Mentagra, iv. 730.
- Mercury in inflammation, i. 119; in syphilis, 418.
- Metacarpus, fracture of the, ii. 557.
- Metatarsus, amputation of, iii. 80; dislocation of, ii. 671; excision of bones of, iii. 829.
- Microscope, use of, in diagnosis, iv. 939.
- Microscopic appearances of encephaloid cancer, i. 527; epithelial cancer, 530; scirrhus cancer, 520; of pityriasis versicolor, iv. 731; of scabies, 732; of tinea, 725.
- Middeldorpf's cautery, iii. 45.
- Miliaria, iv. 720.
- Military hospitals, iv. 1006.
- Military surgery. See *Gunshot wounds*.
- Milk, abnormal secretion of, iv. 675; absence of secretion of, 676; excessive secretion of, 676; congestion with, 676; secretion of, in infancy, 655.
- MINOR SURGERY, iii. 1.
- Moist gangrene, i. 175.
- Moles, iv. 759.
- Mollities ossium, iii. 667.
- Molluscum, ii. 882, iv. 750; of ear, iii. 149.
- Monostoma lentis, iv. 911.
- Morbid poisons, i. 67.
- Mortality of hospitals, iv. 1027.
- Mortification. See *Gangrene*.
- Mother, infection of, by syphilitic fœtus, iv. 830.
- Mother's marks. See *Nævus*.
- Mouth, contraction of orifice of, iv. 959; cysts of, 114; gangrenous stomatitis, i. 177; sebaceous cysts of, iv. 115; malformations of, 806; scalds of, ii. 288; spasmodic closure of, iv. 10, 14.
- Mouth-to-mouth inflation of the lungs, iv. 894.
- Moxa, iii. 25.

- Mucocele, ii. 865.
Mucous cysts, i. 467; polypus, iii. 211; tubercle, i. 439.
Mulberry calculus, iv. 436.
Mumps, iv. 960; producing orchitis, 569.
Muscae volitantes, ii. 766.
Muscles, affections of, in diseases of joints, iii. 762; atrophy of, 529; contraction of, 529; cysticercus in, iv. 907; fatty degeneration of, iii. 529; inflammation of, 525; ossification of, 535; rupture of, 522; rupture of abdominal, ii. 399; rupture of in the upper extremity, 578; syphilis in, iii. 526; tumours of, 539.
Muscular action, fracture produced by, i. 755.
MUSCULAR SYSTEM, AFFECTIONS OF, iii. 522.
Mustard-poultice, iii. 18.
Mutilla coccinea, sting of, iv. 923.
Mydriasis, ii. 773.
Myeloid tumour, i. 490, iii. 678; of jaws, iv. 126.
Myopia, ii. 859.
Nævus, i. 498; condition of glands in, iii. 282; ligature of, 46; of eyelid, ii. 882; of gum, iv. 22; of lips and cheek, 108; of tongue, iii. 905.
Nails, diseases of, iv. 794; evulsion of, 796.
Narcotics, i. 116.
Nasal bones, caries of, iii. 205; fracture of, ii. 260; duct, obstruction of, 865; fossæ, ulcers of, iii. 207; speculum, 204.
Naso-pharyngeal polypus, iii. 219.
Nebula corneæ, ii. 719.
Neck, abscess in, i. 148; aneurism in, iii. 479, 490; burns of, i. 729; enlarged bursæ in, iv. 966; gunshot wounds of, ii. 63; hydrocele of, and hæmatocele, iv. 926; INJURIES OF, ii. 270; regional surgery of, iv. 961; tumours of, cystic, 962; epithelial, 965; glandular, 964; sebaceous, 964; tumours of, removal of, 966; wounds of, ii. 270.
Necrosis, iii. 640; acute, 654; from phosphorus, iv. 40; of laryngeal cartilages, iii. 249; of joint-surfaces, 741; of popliteal surface of femur, iv. 982.
Necrosis-instruments, iv. 1045.
Needles, acupressure, iv. 1039; grooved, 1040; imbedded, i. 607; in the hand, ii. 520.
Nematelmia, iv. 912.
Nephralgia, calculous, iv. 330.
Nephritis, iv. 329.
NERVES, DISEASES OF, iii. 876; affections of, causing inflammation, i. 60; gunshot wounds of, ii. 87; section of, in disease, iii. 893; cerebral, injuries of, ii. 170; of face, injuries of, 249.
Nervous system, symptoms referred to, their value in diagnosis, iv. 935.
Neuralgia, articular, iii. 771; reflex, 886; of the bladder, iv. 357; of the breast, 675; of the kidney, 331; of the rectum, 226; of the spine, iii. 836; of the testicle, iv. 610.
Neuralgic tumour, i. 505; ulcer, 216.
Neuroma, iii. 894; of breast, iv. 684.
Neurotomy, iii. 893.
Ninth cranial nerve, injuries of, ii. 177.
Nipple, anatomy of, iv. 656; erection of, 657; malformations and diseases of, 693.
Nitrate of silver, stains from, ii. 704; stains from internal use of, iv. 760.
Nitrogen gas, death from immersion in, iv. 884.
Nodes, iii. 657, 660.
Noli me tangere. See *Lupus*.
Noma, i. 177; pudendi, iv. 838.
Non-penetrating wounds of the abdomen from gunshot, ii. 65; of the chest from gunshot, 56.
Norwich, statistics of lateral lithotomy at, iv. 462; of median lithotomy at, 470.
NOSE, DISEASES OF, iii. 189; calculi in, 196; cancer of, 189; foreign bodies in, ii. 256; restoration of the, iii. 116; watery discharge from, in injuries of the head, ii. 136; fracture of bones of, 260; wounds of, 253.
Nostrils, occlusion of, iii. 198; plugging of, iii. 211.
Nurses in hospital, iv. 1016.
Nutrition, disorders of, from injury of nerves, iii. 890.
Nyctalopia, ii. 864.
Nystagmus, ii. 801.
Oblique fracture, i. 758; inguinal hernia, iv. 292.
Obstruction of arteries a cause of inflammation, i. 65; lachrymal, ii. 865; of intestines, iv. 152. See *Intestines*.
Obturator artery, wound of, in operation for femoral hernia, iv. 319.
Obturator foramen, dislocation of hip into, ii. 645.
Obturator hernia, iv. 319; diagnosis of, 323; operation for, 323.
Obturator (in cleft palate, &c.), application of, iv. 57.
Occupation, in reference to diagnosis, iv. 930.
Œdema glottidis, iii. 228.
Œdema under conjunctiva, ii. 701.
Œdematous ulcer, i. 215.
Œsophagotomy, ii. 327.
Œsophagus, foreign bodies in, ii. 321; injuries of, from corrosive fluids, 330; wounds of, 274, 281, 384; malformations, iv. 143; dilatation, 143; stricture, 144, hysterical, 146.

- Olecranon process, fracture of, ii. 546.
 Olfactory nerve, injuries of, ii. 171.
 Omentum, protrusion of, from wound, ii. 433; treatment of, in strangulated hernia, iv. 282.
 Onychia maligna, iv. 794; syphilitic, 794, i. 442.
 Opacity of cornea, ii. 718.
 Opening abscesses, i. 162.
 Operations for cancer, i. 557, iv. 691; in hectic, 864; treatment of patients after, 867.
 Ophthalmia, ii. 673; catarrhal, 676; chronic, 699; exanthematous, 698; gonorrhœal, 683; neonatorum, 692; purulent, 679; pustular, 678; rheumatic, 727; scrofulous, 694.
 Ophthalmic artery, aneurism of, iii. 490.
 Ophthalmoscope, the, ii. 775; iv. 1048.
 Ophthalmoscopic appearances in health of the choroid, ii. 779; optic nerve, 779; retina, 778; in disease of the choroid, 784; optic nerve, 785; retina, 780.
 Opisthotonos, i. 303.
 Opium in inflammation, i. 100.
 Optic nerve, injuries of, ii. 172; ophthalmoscopical appearances of, in health, 779; in disease, 785.
 Orbit, abscess of, i. 155, ii. 886; aneurism in, iii. 490; tumours in, ii. 885.
 Orbital nerves, affections of, ii. 886.
 Orchitis, iv. 568; acute, 569; chronic and syphilitic, 573; epididymitis, gonorrhœal, 570; scrofulous, 580; in infants, 570; hernia testis after, 577; suppuration after, 576.
 Orderlies for military hospitals, iv. 1022.
 Organic stricture, iv. 383.
 ORTHOPÆDIC SURGERY, iii. 557.
 Os calcis, see *Calcaneum*; innominatum, see *Pelvis*.
 Osseous ankylosis, iii. 770; tumours, i. 492.
 Ossicles of tympanum, ankylosis of, iii. 178; caries of, 180; fracture of, 180.
 Ossification of arteries, iii. 324.
 Osteoid cancer, i. 533; growth in heart, iv. 684; tumour, innocent, iii. 693.
 Osteo-aneurism, iii. 682.
 Osteo-mycelitis, iii. 628.
 Ostitis, iii. 615, 620; rheumatic, 665; strumous, 656; syphilitic, 660.
 Otorrhœa, iii. 142.
 Ovariectomy, iv. 525; instruments required, 526; after treatment, 527; by long or short incision, 529; treatment of adhesions, 529; management of pedicle, 530; closing of external wound, 532; statistics of, 534.
 Ovary, organic disease of, iv. 518; solid tumours, 519; cysts of broad ligament, 519 cystic disease of, 520; dermoid cysts, 521; tumours of, their rate of growth, 522; spontaneous cure, 523; natural progress of, 523; errors in diagnosis of, 535; gonorrhœal inflammation, 652.
 Oxalate-of-lime calculus, iv. 436; deposit of, in urine, 426.
 Oxygen, effects of its absence, iv. 887.
 Oxyuris vermicularis, iv. 917.
 Ozæna, iii. 208; syphilitic, 205.
 Pain, after contusion, i. 576; after wounds, 604; after gunshot wounds, ii. 28; hysterical, i. 365; in inflammation, 37, 116; its import in diagnosis, iv. 936.
 Palate, cleft, of soft, iv. 88; of hard, 99; tumours of, 88; use of false, 57.
 Palmar arch, wound of, ii. 521; fascia, contraction of, iii. 588.
 Pannus, ii. 688.
 Papulæ, iv. 712, 742.
 Paracentesis abdominis, iv. 181; for ovarian dropsy, 524; capitis, 956; pericardii, ii. 379; thoracis, 369.
 Paralysis after contusion, i. 576; after ligature of artery, iii. 402; agitans, 883; diphtheritic, iv. 64; infantile, 835; reflex, iii. 884; from fracture of spine, ii. 209; from disease of spine, iii. 859; of bladder, iv. 355.
 Paralytic contractions, iii. 558.
 Paramæcium, iv. 903.
 Paraphimosis, iv. 642.
 PARASITES, iv. 902; animal, 903; vegetable, 919.
 Parasitic twins, iv. 803.
 Parasitici, iv. 712, 725.
 Parietes, injury of abdominal, ii. 389; thoracic, 341, 350.
 Paronychia, iii. 544.
 Parotid gland, abscess of, iv. 960; division of duct of, ii. 253; calculus of, iv. 960; hypertrophy of, 957; inflammation of, 960; tumour of, 957; recurrent, 958.
 Partial dislocation, i. 823.
 Patella, dislocation of, ii. 650; fracture of, 620.
 Pavilion hospital, plans of, iv. 995, 1003.
 Pegging, in ununited fracture, i. 805.
 Pelvic abscess, i. 153; cellulitis, iv. 460; viscera, injuries of, ii. 479.
 Pelvis, affection of, in lateral curvature, iv. 846; affection of in rickets, 842, 855; contusions of, ii. 474; fracture and dislocation of, 476; hydatids in, iv. 910; INJURIES OF THE, ii. 474.
 Pemphigus, iv. 733.
 Penetrating wounds of abdomen, ii. 431; from gunshot, 65; of chest, 353; from gunshot, 57.
 Penis, amputation of, iv. 624; cancer of, 623; circumcision of, 624; gangrene of, 622; inflammation of, 635; injuries of, ii. 497; plastic operations

- on, iii. 128. See also *Gonorrhœa*, *Syphilis*.
- Pericardium, wounds of, ii. 375; paracentesis of, 379.
- Pericranium, gunshot wounds of, ii. 43.
- Perineal abscess, i. 157, iv. 410; fistula, 412; hernia, 325; section in stricture, 405.
- Perineum, gunshot wounds of, ii. 71; injuries of, 513; testicle in, iv. 545; rupture of female, 514, iv. 515, operations for, 517.
- Perinephritis, iv. 331.
- Periodical hæmorrhage, i. 655.
- Periosteum, acute abscess of, iii. 624; cancer of, 674; inflammation of, 622; inflammation of, diffuse, 623.
- Periprostic abscess, iv. 364.
- Peritoneum, injuries of the, ii. 403; inflammation of, after contusion, 398; after ruptured bladder, 481; as cause of obstruction, iv. 167; in strangulated hernia, 258; vaginal process of, congenital patency, 234, 546, changes in, 235, state of, at birth, 236, hernia into, 292, into funicular portion of, 295.
- Permanent stricture, iv. 383.
- Peroneal artery, ligature of, iii. 501.
- Petechiæ, iv. 719.
- Phagedæna, i. 186; in groin, iv. 978.
- Phagedænic chancre, i. 458; ulcer, 218.
- Phalanges of hand, dislocation of, ii. 587; compound, 524; fracture of, 558; of foot, dislocation of, 672.
- Phantom-tumours, i. 507.
- Pharyngoscope, iii. 253.
- Pharynx, abscess of, iv. 140; dilatation of, 142; foreign bodies in, ii. 319; inflammation of, iv. 139; injury of, from corrosive fluids, ii. 330; tumours of, iv. 142; ulceration of, 140; wounds of, ii. 281.
- Phimosis, iv. 640.
- Phlebitis, adhesive, iii. 285; suppurative or diffuse, 302.
- Phlebolithes, iii. 305.
- Phlegmonous erysipelas, i. 233.
- Phlyctenular ophthalmia, ii. 694.
- Phlyzacious pustule, iv. 712.
- Phoorsa snake, bite of, i. 624.
- Phosphatic deposits in urine, iv. 427.
- Phosphate-of-lime calculus, iv. 439; triple, calculus of, 439; fusible, calculus of, 440.
- Phosphorus, disease of jaws from, iv. 39.
- Phrenic hernia, ii. 409, iv. 288.
- Phtheiriæ, ii. 879.
- Phthisis with fistula in ano, iv. 205; laryngeal, iii. 243.
- Physiological absorption of Hunter, iv. 629; method of artificial respiration, 893.
- Pia mater, extravasation in the, ii. 111.
- Pigeon-breast, iv. 859.
- Pigment, excess of, iv. 758; want of, 759.
- Piles. See *Hæmorrhoids*.
- Pinguecula, ii. 702.
- Pirogoff's amputation, ii. 85.
- Pituitary membrane, hypertrophy of, iii. 202; chronic coryza of, 203.
- Pityriasis, iv. 745; versicolor, 731.
- Plans of hospitals, iv. 995, 1003.
- Plantar fascia contracted, iii. 565.
- Plaster-of-Paris bandage, iii. 9.
- PLASTIC SURGERY, iii. 108.
- Platyelmia, iv. 904.
- Pleiomazia, iv. 654.
- Pleura, air in, ii. 363; blood in, 364; fluid in, 369; wounds of, 353.
- Pleurosthotonos, i. 304.
- Plica polonica, iv. 761.
- Plugging the nostrils, iii. 211.
- Pneumocele, ii. 355.
- Pneumothorax, ii. 363.
- Pocket-case, iv. 1037.
- Pointing of abscess, i. 145.
- Poisoned wounds, i. 617.
- POISONS, ANIMAL, i. 617.
- Polydactylism, iv. 821.
- Pompholyx, iv. 733.
- Polypus of ear, iii. 146; of nose, 211; gelatinous or vesicular, 211; fibrous, 218; malignant, 222; naso-pharyngeal, 219; of bladder, iv. 350; of rectum, iv. 221; of uterus, 497, operations for, 498, recurrent, 498.
- Pompholyx, iv. 733.
- Pons Varolii, contusion of, ii. 154.
- Popliteal aneurism, iii. 504.
- Popliteal artery, ligature of, iii. 504; rupture of, iv. 982.
- Popliteal space, abscess of, iv. 981; cysts of, 979; enlarged bursæ in, 979; necrosis of femur in, 982; regional surgery of, 978.
- Porrigo, iv. 738.
- Potash, permanganate of, as a disinfectant, i. 747.
- Pott's fracture, ii. 656.
- Pregnancy, changes of breasts in, iv. 658; effect of, on cancer, i. 548; enlargement of thyroid during, iv. 701; general therapia of breast in, 663; inflammation of breast in, 669; extra-uterine, surgical measures in, 512.
- Prepuce. See *Balanitis*, *Chancre*, *Circumcision*, *Herpes*.
- Presbyopia, ii. 861.
- Pressure, artificial respiration by, iv. 892; as antiphlogistic, i. 113; treatment of cancer by, 568; of carbuncle by, iv. 785; of diseases of breast by, 664; of ununited fracture by, i. 798.
- Previous diseases, importance of, in diagnosis, iv. 931.
- Primary adhesion, i. 584; amputation, see *Amputation*; operations in collapse, 721.

- Probang, iv. 1046.
 Probes, iv. 1038; lachrymal, ii. 870.
 Proglottis of *tæniada*, iv. 904.
 Projectiles and their effects, ii. 5.
 Prolapsus of rectum, iv. 194; of uterus, operation for, 517.
 Proliferous cysts, i. 469.
 Prone couch, iii. 874.
 Proptosis oculi, ii. 884.
 Prostate gland, abscess of, iv. 363; acute inflammation, 361; atrophy, 377; calculi, 380, 472; cancer, 377; chronic inflammation, 363, 643; cysts, 379; hypertrophy, or chronic enlargement, 365; hydatids, 381; injuries of, ii. 498; tubercle, iv. 379.
 Prostatic catheter, iv. 371.
 Prostration, stage of, in burns, i. 730; with excitement, 709.
 Protrusion of bowel from wound, ii. 431; of eyeball, 884.
 Prurigo, iv. 743; local, 744; senilis, 743.
 Pruritus ani, iv. 224; pudendi, 744.
 Psoas abscess, iii. 845.
 Psoriasis, iv. 745; of nails, 795; syphilitic, i. 428.
 Psydracious pustules, iv. 712.
 Pterygium, ii. 702.
 Ptosis, ii. 874, 887.
 Puberty, changes of breast at, iv. 656; inflammation of breast at, 668.
 Pubes, dislocation of hip on, ii. 646; puncture of bladder above, iv. 419; symphysis of, diseases of, iii. 785; puncture of bladder through, iv. 419.
 Pudendal hernia, iv. 326.
 Puerperal abscess, i. 154.
 Pulex penetrans, iv. 918.
 Pulleys in dislocation, i. 821.
 Pulsating bronchocele, iv. 702; tumour, i. 506, of bone, iii. 680, diagnosis of, from aneurism, 383, of scalp, iv. 948.
 Punctum lachrymale, displacement of, ii. 869.
 Punctured wounds, i. 596; of abdomen, ii. 429, 446.
 Pupil, closure of, ii. 743; artificial, 753.
 Purgatives in inflammation, i. 108.
 Purpura, iv. 719.
 Purulent deposits, i. 275; ophthalmia, ii. 679; of infants, 692.
 Pus, i. 3; corpuscles of, 28; in the blood, 281; in inflammation of mucous membranes, 33; reabsorption of, 141; varieties of, 143; within the skull, ii. 100.
 Pustulæ, iv. 711, 737.
 Pustular ophthalmia, ii. 678; syphilitic eruptions, i. 431.
 Pustule, malignant, iv. 789.
 Putrid matter, effects of retention of, i. 88.
 PYÆMIA, i. 266; after scalp-wound, ii. 102; exciting causes of, i. 280; pathological anatomy of, 273; table of cases of, 276; in joints, iii. 733.
 Pyelitis, calculous, iv. 331.
 Quilled suture, iii. 16.
 Quinsey, iv. 77.
 Rabid animals, bites of, i. 625.
 Radial artery, aneurism of, iii. 467; ligature of, 468.
 Radical cure of hernia, iv. 242; of hydrocele, 554; of varicocele, 614.
 Radius, dislocations of, ii. 582, 3; fractures of, 548, 551, 552, 556.
 Ranula, iii. 906.
 Rattle-snake, bite of, i. 624.
 Reaction, i. 582, 708.
 Ready method of artificial respiration, iv. 893.
 Reclination of cataract, ii. 809.
 Rectangular flap-amputation, iii. 60.
 Rectangular lithotomy-staff, iv. 466.
 Recto-vaginal fistula, iv. 536, 538; congenital, 813.
 Recto-vesical fistula, iv. 414; congenital, 813; lithotomy, 467.
 RECTUM, DISEASES OF, iv. 183; cancer of, 218; foreign bodies in, ii. 515; imperforate, iv. 812; in narrower sense, 816; colotomy for, 816; injuries of, ii. 514; instruments for operating on, iv. 1047; neuralgia of, 226; polypus of, 221; prolapsus of, 194; puncture of bladder from, 418; stricture of, 211; ulcer of, 206; villous tumour, 224.
 Recurrent tumours, i. 502.
 Redia of trematode, iv. 910.
 Redness, inflammatory, i. 35.
 Reduction of dislocation, i. 819; of hernia, iv. 252.
 Reflex symptoms of diseased nerves, iii. 876.
 Refracture of bones badly united, i. 808.
 REGIONAL SURGERY, iv. 947.
 Registration of cases, table for, iv. 944.
 Renal calculus, iv. 330.
 Repair of wounds and fractures, see *Union*; of arteries after ligature, i. 674.
 Resection in ununited fracture, i. 803; subperiosteal, 804, iii. 802; of bones and joints, see *Excision*.
 Respiration, impossibility of its suspension, iv. 872; artificial, 892; in infants, 897; in threatened death from anaesthetics, iii. 105.
 Respiratory organs, their symptoms in reference to diagnosis, iv. 936.
 Rest in treatment of inflammation, i. 95.
 Retained testicle, iv. 541; condition of, 542; diseases of, 543; complication with hernia, 544.
 Retention of urine, iv. 389, 416; after operations, 871; from enlarged prostate, 420; hysterical, i. 365.

- Retina, affections of the, ii. 745, 770; ophthalmoscopic appearances of in health, 778, in disease, 780.
 Retinitis, ii. 770.
 Retro-pharyngeal abscess, i. 158.
 Rhagades. See *Anus, fissure of*.
 Rheumatic arthritis, iii. 723; iritis, ii. 738; ophthalmia, 727; disease of bones, iii. 665; of joints, 749.
 Rheumatism, gonorrhœal, iii. 735; gouty, 723.
 Rhinoliths, iii. 196.
 Rhinoplasty, iii. 116; death from, 217.
 Ribs, fracture of, ii. 342; resection of, iv. 973; wounds of, ii. 352.
 Rickets, affections of joints from, iii. 750, iv. 840; symptoms, 841; intra-uterine, 842; diagnosis, 843; treatment, 843; from lateral curvature, 852; arrest of growth from, 853; proportion of cranium to face in, 854; undergrowth of pelvis in, 855.
 Rifled arms, wounds by, ii. 4, 7, 11.
 Rigor mortis in apnœa, iv. 874.
 Rodent ulcer, i. 210; of face, iv. 960.
 Roseheads, iv. 1043.
 Roseola, iv. 713; syphilitic, i. 427.
 Rubefacients, iii. 18.
 Rupia, iv. 736.
 Rupture, see *Hernia*. In the sense of 'laceration,' see the name of the part.
 Sac of hernia, development of, iv. 237; injuries of, 270; intraparietal, 272; question of opening, in herniotomy, 276.
 Sac, lachrymal, affections of, ii. 865.
 Sacculated bladder, iv. 349.
 Sacral tumour, congenital, iv. 805.
 Sacro-iliac joint, disease of, iii. 785.
 Sacrum, fractures of, see *Pelvis*.
 Salivary, calculus, iv. 960; fistula, ii. 253; glands, inflammation of, iv. 960.
 Salter's swing, ii. 630.
 Sanguineous cysts, i. 467.
 Sarcopites or acarus scabiei, iv. 732.
 Saw, amputating, iv. 1043; Butcher's, 1042.
 Scab, union under, i. 587.
 Scabies, iv. 732.
 Scalds, i. 727; and see *Burns*.
 Scalp, bandage, iii. 5; blood-tumour of, iv. 948; burns of, i. 729; regional surgery of, iv. 947; wounds of, ii. 96; gunshot, 43; diffuse inflammation of, 97.
 Scalpels, iv. 1037.
 Scapula, displacement of, ii. 518; dislocations of, 562; fracture of, 531; excision of, iii. 805.
 Scar. See *Cicatrix*.
 Scarification, iii. 30.
 Schneiderian membrane, affections of, iii. 202.
 Sciatic notch, dislocation of hip into, ii. 644; hernia through, iv. 326.
 Scirrhus, i. 511; circumscribed, 511; diffused or phagedænic, 517; of special parts, see their names.
 Scissors, iv. 1038.
 Scleronyxis, ii. 817.
 Sclerotic, diseases of, ii. 727; injuries of, 730; injection of, 673.
 Scolex of tæniada, iv. 904.
 Scolopendra and their bites, iv. 922.
 Scoop for lithotomy, iv. 453.
 Scorbatic ulcer, i. 205.
 Scorbutus, iv. 719.
 Scorpion and its bite, iv. 921.
 Scott's bandage, iii. 714.
 SCROFULA, i. 336; causes of, 349; treatment of, general, 355; local, 352; in bone, iii. 655; in glands, i. 350, iii. 271.
 Scrofulous abscess, i. 340; deposit in eye, ii. 857; diathesis, i. 346; disease of joints, iii. 741; disease of testis, iv. 580; dyspepsia, i. 346; iritis, ii. 748; ophthalmia, ii. 694; ulcer, i. 203, 352.
 Scrotal hernia. See *Inguinal*.
 Scrotum, cancer of, iv. 621; elephantiasis of, 618; inflammation of, 618; injuries of, ii. 500; œdema of, iv. 617; stone in, 620; tumours of, 620.
 Sea-snakes, iv. 925.
 Sebaceous tumours, i. 473; of ear, iii. 149; of face, iv. 957; deep of neck, 964.
 Sebaceous tumours perforating the skull, iv. 947.
 Second intention, i. 584.
 Secondary adhesion, i. 587; apnœa, iv. 889; deposits, i. 275; eruptions, 427, pustular, 431, vesicular, 437; gangrene, 185; hæmorrhage, 604, after ligature of artery, 676; syphilitic inoculation, 409; syphilis, 424.
 Semilunar cartilages of knee, subluxation of, ii. 653.
 Seminal flux, iv. 606.
 Senile gangrene, i. 193, iii. 336, amputation in, 339; ulcer, i. 202.
 Sense, organs of, their symptoms in reference to diagnosis, iv. 936.
 Separation of epiphyses, i. 759; of mortified parts, 179.
 Septum of nose, affections of, iii. 199; injuries of, ii. 260.
 Sequestrum, iii. 643.
 Sero-cystic tumour. See *Adenocœle*.
 Sero-cysts of breast, iv. 682.
 Serous cysts, i. 464.
 Serpents, venomous, iv. 924; wounds from, i. 622.
 Serpiginous chancre, i. 459.
 Serresfines, iii. 17.
 Serum in inflammation, i. 25; characters of, in hernial sac, iv. 254.
 Setons, iii. 26; in abscess, i. 163; in bronchocœle, iv. 700; in ununited fracture, i. 800.

- Setting of fractures, i. 771.
 Seventh cranial nerve, injuries of the, ii. 177.
 Sex, in reference to diagnosis, iv. 930.
 Shock, i. 571; after operations, iv. 870; after gunshot wounds, ii. 28. See also *Collapse*.
 Short sight, ii. 859.
 Shot, injuries by various kinds of, ii. 5.
 Shoulder, amputation at, iii. 77; diseases of, 791; dislocation of, ii. 564; excision of, iii. 803; excision of, for gunshot wound, ii. 77; excision of, for tumour of humerus, iv. 970.
 Shoulders, inequality of, in lateral curvature, iv. 845.
 Sickness after chloroform, iv. 871.
 Sight, impairment of, ii. 763.
 Silver, stain of skin from, iv. 760.
 Silver sutures, iii. 13; in plastic operations, 115.
 Silvester's method of artificial respiration, iv. 893.
 Simple fracture, i. 757.
 Sinapisms, iii. 18.
 Sinus, i. 165; in bone, 167. See *Fistula*.
 Site of hospitals, iv. 993.
 Sixth cranial nerve, injuries of, ii. 176; paralysis of, 887.
 Skey's tourniquet, iv. 1042.
 SKIN, DISEASES OF, iv. 709; for separate affections see their names, as *Eczema*, *Pustulæ*; affections of round joints, iii. 765; cancer of, iv. 753; malformations of, 820.
 Skull, fibrous tumour of, iv. 954; fracture of, ii. 113; from gunshot, 46; table of diseases of, iv. 950; trephining the, iv. 1044.
 Sloughing. See *Gangrene*.
 Sloughing phagedæna, i. 186; syphilitic sores, 457; ulcer, 218.
 Small-pox, inoculation of, i. 83.
 Smell, use of, in diagnosis, iv. 943.
 Snakes. See *Serpents*.
 Snow's inhaler, iii. 97.
 Snuffles, the, iv. 830.
 Social condition, in reference to diagnosis, iv. 931.
 Softening, inflammatory, i. 7, of bone, iii. 617; morbid, of bone (mollities), 667.
 Solution of cataract, ii. 814.
 Solvents for stone, iv. 451.
 Soot-cancer, iv. 621.
 Sore-throat, quinsey, iv. 77; of childhood, 80; malignant, 85; ulcerated, 86.
 Sound, beaked, for bladder, iv. 372.
 Sounding for stone, iv. 447.
 Sounds for bladder, iv. 1047.
 Spasm, after fracture, i. 781; after wounds, 605; of bladder, iv. 357; of glottis, iii. 241.
 Spasmodic affections in diseased spine, iii. 862; stricture, iv. 407.
 Spastic contractions, iii. 559, 583.
 Specific antiphlogistic remedies, i. 117.
 Speculum auris, iii. 138; nasi, 204; vaginae, iv. 1047; use of, in diagnosis, 940.
 Spent-balls, ii. 12, 24.
 Spermatic cord, hydrocele of, iv. 661; diffused, 563; injuries of, ii. 501; tumours of, iv. 615; varicocele, 612.
 Spermatorrhœa, iv. 604.
 Spermatozoa in encysted hydrocele, iv. 558.
 Sphacelus. See *Gangrene*.
 Sphincter ani, spasmodic contraction of, iv. 208.
 Spiders and their bites, iv. 922.
 Spina bifida, iv. 807; excision of, 811; injection of, 810; ligature of, 810; false, 811.
 Spina ventosa, iii. 675.
 Spinal cord, concussion of, ii. 239; disease of, in spinal disease, iii. 858; inflammation of, after fracture, ii. 243; injuries of, in fracture, 207.
 Spinal instruments, iv. 858, 1051.
 Spine, cancer of, iii. 864; DISEASE OF, 831; dislocation of, ii. 203; fracture of, 203; gunshot wound of, 51; hysterical affection of, i. 363, iii. 836; injuries of, ii. 197; LATERAL DISTORTION OF, iv. 844. See *Curvature*.
 Spiroptera hominis, iv. 918.
 Spleen, gunshot wound of, ii. 67; rupture of, 420.
 Splintered fracture from gunshot, ii. 76.
 Splinters in gunshot wounds, ii. 17.
 Splints, i. 774; gutta-percha, iii. 10.
 Spontaneous combustion, i. 728; fracture, iii. 701.
 Sprains of the back, ii. 198; lower extremity, 591; upper extremity, 517.
 Squamæ, iv. 712, 745.
 Squint, ii. 889.
 Staff for lithotomy, iv. 453, 1048.
 Stains on conjunctiva from caustic, ii. 704.
 Stapes, ankylosis of, iii. 178.
 Staphyloma of iris, ii. 681, 755; of sclerotic, 752.
 Staphylorrhaphy, iv. 94.
 Starched splint, iii. 10.
 Starvation, as cause of inflammation, i. 64; experiments on, iv. 890; treatment of inflammation by, i. 108.
 Stasis of blood, artificial, i. 22; inflammatory, 21.
 Statistics of fracture of lower extremity, ii. 593; of fracture and dislocation of upper extremity, 525; of hospitals, iv. 1024; of ligature of arteries, iii. 403; of ovariectomy, iv. 534.
 Steno's duct. See *Parotid*.
 Sterno-clavicular joint, disease of, iii. 790.
 Sterno-mastoid muscle, contraction of, see *Wry-neck*; division of, iii. 593;

- induration of, iv. 965; tumour of, iii. 528.
- Sternum, fracture of, ii. 348; resection of parts of, iv. 973; wound of, ii. 352.
- Stertor, phenomena of, iii. 101.
- Stimulants in inflammation, i. 125.
- Stings of bees, wasps, &c., iv. 923.
- Stomach, blow on pit of, ii. 389; fistula of, 450; foreign bodies in, 465; gunshot wound of, 67; hernia of, iv. 290; rupture of, ii. 410; wounds of, 446, 447.
- Stomach-pump, iv. 1046.
- Stone. See *Calculus*.
- Strabismus, ii. 889.
- Strangulated hernia. See *Hernia*, *Herniotomy*.
- Strangulation, iv. 879; treatment of, 897; of intestine protruded from wounds, ii. 436.
- Strapping the breast, iv. 665; the testis, 578.
- Streatfield's forceps for the eye, iv. 1050.
- Stricture of hernia, iv. 238, 248, division of, 275; of intestine, 168; of cesophagus, 144; of rectum, 211.
- Stricture of urethra, iv. 383; linear, 383; annular, 384; indurated annular, 384; irregular or tortuous, 384; locality of, 385; causes of, 386; symptoms of, 388; simple, irritable, and contractile, 391; dilatation of, 391-5; continuous, 397; sudden, 398; caustic treatment, 400; spasmodic, 407; inflammatory, 409; incision of, see *Urethrotomy*; forcing of, 418.
- Strongylus gigas, iv. 917.
- Strophulus, iv. 740.
- Struma and Strumous. See *Scrofula* and *Scrofulous*.
- Strychnia poisoning, distinguished from tetanus, i. 314; effect of, in retarding oxidation, iv. 888; in bronchocele, 700.
- Stye, ii. 877.
- Style, passage of, for lachrymal obstruction, ii. 869.
- Styptics, i. 664.
- Subaponeurotic cephalæmatoma, iv. 948.
- Subclavian artery, ligature of, iii. 476; in first part, 483.
- Subclavicular dislocation of humerus, ii. 572.
- Subconjunctival tissue, affections of, ii. 701.
- Subcoracoid dislocation of humerus, ii. 565.
- Subcutaneous ligature, iii. 46; wounds, i. 599.
- Subglenoid dislocation of humerus, ii. 570.
- Subluxation. See *Dislocation*, *partial*.
- Submammary abscess, i. 156, iv. 671-2.
- Submersion. See *Drowning*.
- Subpericranial cephalæmatoma, iv. 949.
- Subspinous dislocation of humerus, ii. 573.
- Sudamina, iv. 719.
- Sudden death from blow on epigastrium, ii. 389.
- Suffocation, iv. 878; treatment, 896; of new-born children, 897.
- Suppression of urine, iv. 337.
- Suppuration, i. 3, 141; in the hand, ii. 519; in cornea, ii. 713.
- Supra-coracoid dislocation of humerus, ii. 573.
- Supra-mammary abscess, iv. 670.
- Supra-pubic lithotomy, iv. 467.
- Supra-renal capsules, discoloration from disease of, iv. 759.
- Suspensory bandage, iii. 7.
- Sutures, i. 591, iii. 11; in amputation, iii. 69; in cut-throat, ii. 279; continuous, iii. 12; in wounds of abdomen, ii. 437; intestine, 442; scalp, 96; interrupted, iii. 13; silver or wire, 13; twisted, 15; in plastic operations, 115; quilled, 16; shot, 116.
- Sutures (of the skull), separation of, ii. 130.
- Swallowed substances causing obstruction of larynx, ii. 303, 319, iv. 895.
- Swelling, inflammatory, i. 36.
- Sycosis, iv. 730.
- Syme's amputation, iii. 82; operation for stricture, iv. 405.
- Symphysis pubis, disease of, iii. 785; puncture of bladder through, iv. 419.
- Symptoms of disease, in reference to diagnosis, iv. 934.
- Synchysis, ii. 791; sparkling, 791.
- Syncope, i. 707; effects of, in drowning, iv. 883.
- Synechia, ii. 743.
- Synovial follicles, dilatation of, iv. 979.
- Synovial membranes, anatomy of, iii. 704; gelatinous degeneration of, 717; inflammation of, acute, 706; chronic, 709; gonorrhæal, 734; gouty, 729; pyæmic, 733; rheumatic, 723; scrofulous, 717; syphilitic, 735.
- Syphilides, or syphilitic eruptions, i. 427.
- Syphilis, i. 375; congenital, ii. 746, iv. 829; constitutional, i. 400; destructive, 457; infantile, iv. 832; local, i. 446; in muscles, iii. 526; pathology of, i. 389; primary, varieties of, 398; secondary, 424; suppurative, 446; tertiary, 441; ulcerative, 450.
- Syphilisation, i. 384.
- Syphilitic alopecia, i. 442; affections of bones, iii. 660; of joints, 749; of larynx, iii. 234; of lip, iv. 111; of lymphatics, iii. 275; of mucous membranes, i. 439; of muscles, 526; of nails, iv. 795; of nose, iii. 190; of periosteum, 660; of pharynx, iv. 141; of skin, i. 427; of testis, 444, iv. 573; of teeth, 834; of tongue, iii. 908; of tonsils, i. 440; tethyma, i. 433; impetigo, 433; inoculation, 377; iritis, ii. 741; kera-

titis, 711; lepra, i. 428; lichen, 427; onychia, 794; orchitis, iv. 573; psoriasis, i. 428; roseola, 427; synovitis, iii. 735; tubercle, i. 427; ulcer, 206, 438. Systemic infection, i. 266.

Table for registration of cases, iv. 944.

Tæniada, iv. 904; the scolex and proglottis, 904; the hexacanthus, 905; mode of propagation, 905.

Tagliacotian operations, iii. 108.

Talipes calcaneo-valgus, iii. 579; equinus, 578; valgus, 579; varus, 562.

Tape-worms. See *Tæniada*.

Tapping. See *Paracentesis*, *Hydrocele*.

Tarantula and its bite, iv. 922.

Tarsus, amputation through, iii. 82; diseases of joints of, 789; dislocations in, ii. 659; excisions of bones of, iii. 826; fractures of, ii. 634.

Taxis. See *Hernia*.

Teale's method of amputation, iii. 60.

Teale's suction-curette, iv. 1050.

TEETH, DISEASES CONNECTED WITH THE, iv. 1; difficult eruption of back, 9; hæmorrhage after extraction of, 53; impaction of, 33.

Temperature in inflammatory fever, i. 47; of water, effects of, in drowning, iv. 884.

Temporal artery, bleeding from, iii. 35; traumatic aneurism of, 441.

Temporo-maxillary articulation, disease of, iii. 794.

Tenaculum, iii. 73.

Tendo Achillis, division of, iii. 572; rupture of, 543.

Tendons, inflammation of, i. 33, iii. 544; rupture of, ii. 518, iii. 541; tumours of, 547; union of, after division, 542.

Tenotomy, iii. 562.

Tertiary syphilis, i. 441.

Testicle, absence of, iv. 540; atrophy of, 609; bony deposit in, 599; calcareous deposit in, 599; cancer of, 594; cancer of, diagnosis of, 597; changes of position (natural), 539; cystic disease of, 587; cysts of, 557; development of, 539; development of, imperfect, 540; enchondroma of, 591; fibro-cystic tumour, 588; fibrous tumour, 593; functional diseases of, 603; hæmatocele, 564, encysted, 566; hernia of, 577; hydrocele, 547, and see *Hydrocele*; imperfect growth of, 546; inflammation of, 568, and see *Orchitis*; injuries of, ii. 501; inversion of, iv. 547; misplaced, 545; neuralgia of, 610; removal of, 601; retention of, 541, and see *Retained testicle*; scrofulous disease of, 580; supernumerary, 540; suppuration of, 576; syphilitic disease, i. 444, iv. 573; varicocele, 612, operations for, 614.

Test-types for the eye, iv. 1049.

TETANUS, i. 299; causes, idiopathic, 309; traumatic, 306; complications, 304; in gunshot wounds, ii. 89; neonatorum, i. 304; reflex, iii. 879.

Thecal abscess, i. 161.

Thigh, amputation of, iii. 88.

Thigh-bone. See *Femur*.

Third cerebral nerve, injuries of the, ii. 173; paralysis of, 887.

Third intention, i. 587.

Thompson's stricture-dilator, iv. 399; trocar, iv. 1047.

Thoracic vessels, wounds of, ii. 383.

Thorax, viscera, rupture of, ii. 385; abscess of wall of, iv. 972; disease of bones of, 972; injuries of, ii. 340; bandage for, iii. 3.

Throat, injuries of, ii. 270.

Thromballosis, iii. 291.

Thrombus, iii. 286, 291, 296.

Thumb, dislocation of, ii. 584; amputation of, iii. 75.

Thyroid arteries, ligature of, iv. 699.

THYROID GLAND, DISEASES OF, iv. 696; extirpation of, 696; hypertrophy or bronchocele, 697, and see *Bronchocele*; pulsating or exophthalmic bronchocele, 702; inflammation, 706; cancer, 707.

Thyroid hernia. See *Oblurator*.

Tibia, fracture of, ii. 633.

Tibial arteries, aneurism of, iii. 500; ligature of anterior, 500; ligature of posterior, 502.

Tibialis anticus tendon, division of, iii. 569; posticus tendon, division of, 572.

Tic douloureux, iii. 886.

Tinea, iv. 725; ciliaris, ii. 878; decalvans, iv. 729; favosa, 727; syccosis, 730; tonsurans, 725.

Toe-nail, ingrown, iv. 795; evulsion of, 796.

Toes, amputation of, iii. 79; division of tendons of, 609.

TONGUE, DISEASES OF, iii. 896; abscess of, 902; cancer of, 909; cracks of, 902; extirpation of, 914; inflammation of, 900; nævus of, 905; ulceration of, 902.

Tongue-tie, iv. 118.

Tonics in inflammatory affections, i. 124.

Tonsil, abscess of, i. 158, iv. 78; acute inflammation, 77; enlarged, iii. 160, iv. 81, producing deformity of chest, 860.

Tonsil-guillotine, iv. 1042.

Tonsillitis, iv. 77; maligna, 85.

Tooth-pulp, polypus of, iv. 23; sensitive growth of, after fracture, 24.

Torticollis, iii. 590.

Tour de maître, iv. 392.

Tourniquet, iii. 55, iv. 1042.

Trachea, foreign bodies in, ii. 304; rupture of, 286; wounds of, 274.

- Tracheotomy, ii. 311; in bronchocele, iv. 701; in croup, 76; in diphtheria, 70; for foreign bodies, ii. 308; trocars for, iv. 1046.
- Trachoma, ii. 688.
- Transfusion, i. 664.
- Transplantation of parts, iii. 112.
- Traumatic aneurism, iii. 354, 438; cataract, ii. 805; fever, i. 582, iv. 865; gangrene, i. 183; iritis, ii. 736; tetanus, i. 306.
- Treatment, effects of, in reference to diagnosis, iv. 933.
- Trematoda, iv. 910.
- Trephines, iv. 1043.
- Trephining the skull, iv. 1044; for abscess of brain, ii. 192; for blood between bone and dura mater, 108; for fracture of skull, 117; for fracture of base of skull, 129; for pus beneath the skull, 101; for gunshot wounds, 49.
- Trephining the spine, ii. 235.
- Trichiasis, ii. 876.
- Trichina spiralis, iv. 913; generation of, 913; symptoms of, 914.
- Trichomonas vaginæ, iv. 903.
- Trismus, i. 303; infantum, 304.
- Trochanter major, fractures of, ii. 607, 608.
- Trocars, iv. 1046.
- True aneurism, iii. 346.
- Trusses, iv. 240.
- Tsetse and its bite, iv. 923.
- Tubercle, i. 337; calcareous degeneration of, 340; chemical characters, 339; crude, 337, 339; encysted, 338; excreted from mucous membranes, 340; its relative frequency in different organs, 342; microscopic characters, 338; miliary, 337, 341; mucous, 439; nature of, 343; syphilitic, 427; of bone, iii. 657; of testis, iv. 583.
- Tubercula, iv. 712, 747.
- Tuberous cystic tumours. See *Adenocoele*.
- TUMOURS, i. 462; cartilaginous, 486, and see *Enchondroma*; cystic, 464; erectile, 497; fatty, 476, and see *Fatty tumour*; fibro-cellular, 479; fibrous, 482; floating, 506; glandular, 495; innocent, 463; malignant, 508, and see *Cancer*; myeloid, 490; neuralgic, 505; osseous, 492, and see *Exostosis*; phantom, 507; pulsating, 506; recurrent, 502; vascular, 497; of various organs and systems, see their names.
- Tunica vaginalis testis, loose bodies in, iv. 567; and see *Hydrocele*, *Hiernia*.
- Twins, joined, iv. 803.
- Twisted suture, iii. 15.
- Tympani membrana, artificial, iii. 158; deposits in, 155; diseases of, 150; examination of, 137; inflammation of, 152; injuries of, 151; perforation of, 156; puncture of, 165; relaxation of, 154; rigidity of, 154; ulceration of, 155.
- Tympanum, affections of ossicula of, iii. 178; chronic inflammation of, 171; deposits in, 174; diseases of, 166; membranous bands in, 175; rigidity of mucous membrane of, 177.
- Tyrrell's hook, ii. 757.
- Ulceration, i. 7, 196; of bladder, iv. 348; of cartilage, i. 32, iii. 757; of intestines in burn, i. 741; of scars, 616; of tongue, iii. 902; from anæmia, i. 65.
- Ulcerative syphilitic inflammation, i. 450.
- ULCERS, i. 196; cancerous, 212, 516; cancrroid, 210; chronic, indolent, or callous, 217; cold, 201; eczematous, 200; exuberant, 215; gouty, 206; hæmorrhagic, 216; healthy, 199; inflamed, 216; inflammatory, 199; lupous, 209; neuralgic or irritable, 216; oedematous or weak, 215; phagedænic or sloughing, 218; rodent, cancrroid, or lupoid, 210; scorbutic, 205; scrofulous, 203, 352; senile, 202; syphilitic, 206, 438; varicose, 214.
- Ulna, dislocation of, ii. 583; fractures of, 551; of coronoid process, 546; of olecranon process, 546.
- Ulnar artery, aneurism of, iii. 467; ligature of, 468.
- Ulnar nerve, wound of, iii. 810.
- Umbilical hernia, iv. 289; operation for strangulated, 291; radical cure of, 290.
- Umbilical vein, inflammation of, iii. 305.
- Umbilicus, fistula at, iv. 818; malformations, patent urachus, 818; warty tumour of, 818.
- Union of wounds, i. 583; adhesive, 584; defective, 607; diseases of, 607; by granulation, 584; immediate, 583; by secondary adhesion, 587; under a scab, 587; of fractures, 785; of compound fractures, 789; of complicated fractures, 792; of fractures of base of skull, ii. 129.
- Unreduced dislocation, i. 816.
- Ununited fracture, i. 793.
- Upper extremity. See *Extremity*.
- Upper jaw. See *Jaw*.
- Urachus, patent, iv. 818.
- Uranoplasty. See *Palate, hard*.
- Urate-of-ammonia calculus, iv. 436.
- Urates, deposits of, in urine, iv. 426.
- Ureter, malformation of, iv. 337; morbid conditions of, 338; rupture of, ii. 424.
- Urethra, abscess of, iv. 410; fistula of, 412; laceration of, by instruments, ii. 495; in chordee, 497; in stricture, iv. 421; by violence (rupture), ii. 490;

- inflammation, iv. 630; malformation, 382; stricture, 383, and see *Stricture*; tumours, 409; wounds, ii. 489. See also *Calculus*.
- Urethra, female, dilatation of, or *lithectasy*, iv. 476; hæmorrhoids or vascular tumours of, iv. 491.
- Urethritis, causes of, iv. 630.
- Urethroplasty, iv. 415.
- Urethro-rectal fistula, iv. 414; congenital, 813.
- Urethrotomes, iv. 402.
- Urethrotomy, iv. 401.
- Urethro-vaginal fistula, iv. 536.
- Uric-acid calculus, iv. 435; deposits in urine, 425.
- Uric-oxide calculus, iv. 436; deposits in urine, 426.
- Urinary abscess, iv. 410; deposits, 425; fistula, 412; organs, DISEASES OF, 327, diseases of, in fractured spine, ii. 221; organs, symptoms referred to, their importance in diagnosis, iv. 938.
- Urine, blood in, iv. 334; cancer-cells in, 379; deposits in, 425; extravasation of, from ruptured bladder, ii. 482; from ruptured kidney, 422; from ruptured ureter, 424; from ruptured urethra, 491, iv. 421; incontinence of, 357; overflow of, 360; retention of, 389, 416; retention of in female, 1040, hysterical, i. 365; suppression of, iv. 337.
- Uro-stealith calculus, iv. 441.
- Urticaria, iv. 717.
- Utero, fracture in, iv. 826.
- Uterus, cancer of, iv. 506; cervix, excision of, 508; fibrous tumour of, 500; gonorrhœal inflammation of, 652; injuries of impregnated, viz. contusion, ii. 506, rupture in parturition, 507, wounds, 504; of unimpregnated, 504; malformations, iv. 492; polypus, 497; prolapsus, 516.
- Uvula, relaxed, iv. 87.
- Vaccination, iii. 36; syphilis conveyed in, iv. 831.
- Vagina, cancer of, iv. 507, 510; contracted cicatrix of, iii. 130; foreign bodies in, ii. 512; injuries of, 509; laceration in coitu, 511; laceration in parturition, 511; laceration with protrusion of viscera, 438; malformations, iv. 492; parasitic infusoria in, 903; tumours of, in infancy, 840. See also *Leucorrhœa*.
- Vaginal fistulæ, iv. 536; hernia, 326; lithotomy, 477; process, see *Peritoneum*; speculum, iv. 1047.
- Valsalva's treatment of aneurism, iii. 365.
- Varicocele, iv. 612.
- Varicose aneurism, iii. 447; ulcer, i. 214; veins, iii. 308.
- Varix, aneurismal, iii. 447; arterial, 454; of lymphatics, iii. 283; veins, 308, species of, 313.
- Vas deferens, rupture of, ii. 502.
- Vascular tumour, i. 497; of bone, iii. 682; of breast, iv. 684; of gum, 22; of jaw, 130; of scalp, 948; of urethra (female), 491.
- Vegetations, syphilitic, iv. 770.
- Veins, atrophy of, iii. 307; coagulation in, 291; concretions in, 305; DISEASES OF, 285; entrance of air into, i. 696; hypertrophy of, iii. 306; inflammation of, 285; obstruction of, 321; parasites in, 322; umbilical inflammation of, 305; varix of, 308; wounds of, i. 694, iii. 289.
- Venesection, iii. 33.
- Venom of serpents, its nature and effects, iv. 926.
- Venomous insects, iv. 921; serpents, i. 623, iv. 924.
- Venous nævi, i. 498.
- Ventilation of hospitals, iv. 994-1000.
- Ventral hernia, ii. 400, 431, iv. 289.
- Verruca. See *Wart*.
- Vertebræ. See *Spine*.
- Vesicants, iii. 19.
- Vesico-intestinal fistula, iv. 348.
- Vesico-prostatic calculus, iv. 473.
- Vesico-rectal fistula, iv. 414.
- Vesico-congenital, iv. 813.
- Vesico-uterine and vaginal fistula, iv. 536.
- Vesiculæ, iv. 711, 719.
- Vesiculæ seminales, affections of, iv. 615.
- Vesicular eruptions, syphilitic, i. 437.
- Vesicular polypus of nose, iii. 211.
- VESSELS, INJURIES OF, i. 666; in inflammation, 16.
- Vibices, iv. 719.
- Vicarious menstruation, i. 655.
- Vienna paste, iii. 24.
- Villous tumour, i. 536; of bladder, iv. 351; of rectum, 224.
- Viperine snakes, their characters, iv. 924.
- Viscera. See *Abdomen*, *Pelvis*, *Thorax*.
- Vision, impaired, ii. 763.
- Vitiligo, iv. 760.
- Vitreous body, diseases of, ii. 790; hæmorrhage into, after extraction of lens, 829.
- Volvulus, iv. 155.
- Vomit, nature of, in hernia, iv. 257.
- Vulva, injuries of, ii. 512; malignant disease of, iv. 510; non-malignant diseases of, 511.
- Waist, distortion of, in lateral curvature, iv. 845.
- Wakley's stricture-instruments, iv. 398.
- Wards, proportion of hospital, iv. 1008.
- Warts, iv. 769; cadaveric, 771; confluent, 770; subungual, 769; venereal, 770; of the eyelids, ii. 882; of the scalp, iv. 769.

- Warty tumour of cicatrices, i. 617; of umbilicus, iv. 818.
- Wasp-stings, iv. 923.
- Watery discharges in injuries of head, ii. 131.
- Wax, accumulated, in ear, iii. 138.
- Weak ulcer, i. 215.
- Webbed fingers, iv. 821.
- Weiss's lithotrite, iv. 1048.
- Wells's trocar, iv. 1047.
- Wet-nurses, infection of, by syphilitic children, iv. 833; from, to infants, 831.
- Whitlow, iii. 544.
- Windage of cannon-balls, ii. 19.
- Wisdom-teeth, difficult eruption of, iv. 9.
- WOMEN, SURGICAL DISEASES OF, iv. 491.
- Woolwich, plan of Herbert Hospital at, iv. 1003.
- Wounded soldiers, their after usefulness, ii. 94.
- WOUNDS, i. 578; contused, 597; dissecting, 617; GUNSHOT, ii. 1; incised, i. 578; lacerated, 599; poisoned, 599, 617; punctured, 596; subcutaneous, 599; complications of, 602; increased number of, in modern battles, ii. 11; union of, i. 583; from diseased animals, 625; from healthy animals, 622, iv. 921, 926; of special organs, see their names.
- Wrist, amputation at, iii. 76; diseases of, 793; dislocations at, ii. 584; excision of, iii. 812; fractures near, ii. 552.
- Wry-neck, congenital, iii. 590; paralytic, 596; spasmodic, 595; from diseased spine, 596.
- Wutzer's operation for radical cure of hernia, iv. 243.
- Xanthine or xanthic oxide deposit, iv. 426; calculus, 436.
- Xerodermata, iv. 712, 760.
- Yaws, iv. 756.
- Zinc, chloride of, as caustic, iii. 41.

THE END.



LONDON :

ROBSON AND SON, GREAT NORTHERN PRINTING WORKS,
Pancras Road, N.W.

